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Avian Responses to Management of Riparian Habitat in the Prineville District, Bureau of Land Management, Central Oregon

Report of 1999 and 2000 Field Activities
Draft: December 19, 2000

Presented to:
The Bureau of Land Management,
Oregon State Office & Prineville District Office

Prepared by:
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Wildlife Conservation Society

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Executive Summary

In 1999 and 2000, we (the *Wildlife Conservation Society*) collaborated with the Bureau of Land Management, Prineville District, to examine the response of the riparian songbird community to recent management practices in riparian habitats throughout the District. Management of these systems has included assessment for "proper functioning condition" (PFC), and a "seasonal" grazing management strategy. The result of these management activities has been a restoration of riparian functionality and a substantial increase in the woody vegetation complexity on many of the systems. Fourteen riparian study sites were evaluated in 1999 and ten were evaluated in 2000. Across all study sites, riparian habitat type varied from wet meadow habitat to riparian woodland habitat, and condition varied from degraded and non-functioning, to functioning and in good condition. A total of 70 and 74 avian species were observed across all study sites in 1999 and 2000 respectively. In 1999, 15 riparian species, including ten species considered "riparian-dependent" and five species considered "obligate species", were observed; in 2000, 17 riparian species, including 12 dependent and five obligate species, were observed. To examine the response of the songbirds to this riparian management, we conducted a specific bird-habitat model analysis. We evaluated the relationship between the songbird community and those features of the woody vegetation that are affected by livestock grazing and that indicate PFC of the riparian system. Both the average width of the woody riparian zone, and the average height of the riparian shrub vegetation were found to be positively associated with the number of riparian associated species, both obligates and dependents, that are found in a given area. The results from our research support the general prediction that the riparian songbird community is negatively affected by those changes in the woody vegetation complexity that result from traditional livestock grazing management, and is positively affected by management activities that increase woody vegetation complexity. Based on these results, we recommend management activities which promote increases in the width and height of the woody riparian zone, and which also promote correlated increases in overall diversity, structural complexity and total cover of the woody riparian vegetation, in order to restore a complex riparian songbird community. We also evaluated each study site with regards to its ability to provide riparian woodland habitat to riparian "indicator" songbird species. Many of the sites with potential to support riparian woodland habitat were in good condition and providing good songbird habitat, and therefore were likely responding well to management activities. Some sites which did have the potential to support riparian woodland songbirds were not meeting this potential, and perhaps require further management and time to fully restore the woody vegetation complexity. We provide some qualitative species-specific recommendations for management which include promoting a dense, complex understory habitat for Yellow Warblers, Yellow-breasted Chats and others, and tall riparian trees or snags for Western Wood Pewees, Bullock's Orioles, and others. Through this research we have demonstrated that the riparian songbird community is positively associated with increasing woody vegetation complexity. We believe that this research also demonstrates that the key to restoration of riparian habitat for songbird occupancy is management that is guided by those features of the woody vegetation affected by livestock grazing, and that are important to riparian songbirds, regardless of whether management includes cattle grazing or not.

Introduction

Background

Riparian habitat comprises less than one percent of land in the west yet is one of the most productive habitats supporting a large diversity of aquatic and terrestrial wildlife (Knopf et al. 1988a). The major functions of a riparian system include the physical filtering of water by vegetation, the stabilization of banks and floodplains by vegetation, the storage of water and the recharge of underground aquifers (Patten 1998; Elmore 1989). These functions are supported by a diversity of grasses, sedges, rushes, forbs, shrubs and trees within the riparian zone.

Because of the presence of water and the associated vegetation, riparian habitat is differentially important to human activity in the landscape of the arid west. As a result it has been exploited and degraded or lost completely through livestock grazing, conversion to agriculture, water management practices, timber harvest, urbanization and recreation (Knopf et al. 1988a; Saab et al. 1995; Saab and Rich 1997). In the west, it is estimated that at least 95% of riparian habitat has been lost, altered, or degraded (Ohmart 1994).

Improper livestock grazing has been one of the major causes of the extensive degradation of riparian habitat in the west (Kreuper 1993). Alterations of the instream and streambank vegetation in riparian systems under improper livestock grazing management have been well documented (e.g. Dobkin et al. 1998; Knopf et al. 1988b; Medin and Clary 1990; Mosconi and Hutto 1981; Schulz and Leininger 1991; Taylor 1986). The removal of riparian and upland vegetation due to livestock grazing and the compaction of streambanks by hoof action, results in destabilization of streambanks, incision of the stream channel, lowering of the water table, and an encroachment of upland plant species into the riparian zone (Belsky et al. 1999). Overall woody vegetation complexity is diminished, including decreased cover by riparian trees and shrubs, simplified horizontal and vertical vegetation structure, lower diversity of riparian species and an overall reduction in the riparian habitat area (Belsky et al. 1999).

The same characteristics that make riparian habitat important to humans and livestock, make riparian habitat important to various wildlife populations. In arid regions, riparian habitat is disproportionately important to bird populations (Bock et al. 1993; Kreuper 1993; Saab et al. 1995; Saab and Rich 1997). Breeding diversity of birds is higher in western riparian habitat than all other western habitats combined (Kreuper 1993). As well as being important to breeding birds, riparian habitat is used by wintering landbirds and as stop-over sites for migrating birds (DeSante and George 1994). Loss of riparian habitat has been suggested as the major factor contributing to declines of landbirds in western North America (DeSante and George 1994).

Because livestock grazing is a major cause of the loss and degradation of riparian habitat in the west, the effects of grazing on bird populations have been well studied. A negative response of riparian birds to improper livestock grazing management has been well documented (e.g. Crouch 1982; Dobkin et al. 1998; Medin and Clary 1990; Medin and Clary 1991; Mosconi and Hutto 1981; Sedgwick and Knopf 1987; Schulz and Leininger

1991; Taylor 1986; Taylor and Littlefield 1986). The negative response of riparian birds to livestock grazing is associated with the grazing-related changes in the structure and composition of the woody vegetation that comprises nesting and foraging habitat (Bock et al. 1993; Mosconi and Hutto 1981). .For example, increases in Yellow Warbler (*Dendroica petechia*) populations, which nest and forage in the willows associated with riparian areas, were attributed by Taylor and Littlefield (1986) to increases in the amount of healthy willows that resulted when livestock grazing, and willow cutting and spraying, were stopped in the area.

Like the study by Taylor and Littlefield (1986), most studies examining the effects of livestock grazing on riparian habitat and bird communities, have focused on responses to cessation of livestock grazing and other grazing management strategies, for example, rest rotation grazing (e.g. Clary et al. 1996; Dobkin et al. 1998; Kauffman et al. 1983; Mosconi and Hutto 1981; Sedgwick and Knopf 1987; Sedgwick and Knopf 1991). However, because each riparian area is unique, the results of a given management strategy may differ among streams both within and between watersheds (Belsky et al.1999). Management using a single grazing strategy across several systems ignores the complex interactions between vegetation, hydrology and geomorphology present in each unique system. Restoration of riparian habitat is most likely to occur when restoration of the processes and functions that support riparian habitat occurs. Common among all management strategies should be the goal of restoring the natural functions and processes of the riparian system.

Restoring the natural functions and processes of the riparian system is the goal of the "proper functioning condition" (PFC) assessment tool. PFC is a methodology that was developed for assessing the physical functioning of riparian and wetland areas through consideration of hydrology, vegetation, and soil/landform attributes (NRST 1997). Riparian systems are defined to be in "proper functioning condition" if they possess adequate vegetation, landforms or large woody debris to dissipate stream energy and reduce erosion, provide physical filtering of water, enhance bank stability and enhance flood-water retention and ground-water recharge (Prichard 1995; see Appendix 1). Woody vegetation complexity can be restored to riparian systems which have previously been in non-functioning condition but which are maintained in PFC for a period of time, and which have the natural potential. Therefore, management activities that include assessment for PFC can assist in restoring those features of the riparian habitat that are affected by livestock grazing.

Research Activities

The purpose of this study was to examine the response of riparian-associated avifauna to management for riparian restoration using the "proper functioning condition" criteria. To address this problem, study sites were established in riparian habitat located primarily within the Bureau of Land Management (BLM) Prineville district of Oregon. Over the past 20 years, this district has been engaged in riparian restoration on the streams in this area. They have used the criteria outlined in the protocol to assess riparian systems for "proper functioning condition", and manipulated timing and duration of cattle grazing as necessary. When livestock grazing is included in the management strategy for a riparian system, a "seasonal grazing" strategy was used. This strategy prohibits grazing during the growing season of riparian vegetation.

We focused on the response to management activities of those species associated primarily with riparian habitat in eastern Oregon. Assessing the response of riparian songbirds to the management strategies in this area would be accomplished by relating the riparian songbird community to those characteristics of the riparian habitat that are affected by livestock grazing and indicate "proper functioning condition" of riparian systems, i.e. characteristics of woody vegetation complexity including width, height and structural diversity. Riparian associated species are those that have been defined as either riparian obligates or riparian dependents. Partners in Flight (BLM/PIF) define riparian obligate species as those that "place >90% of their nests in riparian vegetation during the breeding season". Riparian dependent species are defined as those that "place 60% - 90% of their nests in riparian vegetation or for which 60% - 90% of their abundance occurs in riparian vegetation during the breeding season. Appendix 2 lists all riparian species in eastern Oregon categorized by riparian association. Included in this Appendix are general habitat associations and geographical distributions in eastern Oregon for each species as described in Csuti et al. (1997), Ehrlich et al. (1988), Gilligan et al. (1994) and the Lanius InFlight Database (1998). Also noted are federal and state statuses of all species, and those species requiring conservation action as defined by PIF. Finally, in our evaluations of study sites we take special consideration of riparian indicator species. Riparian indicator species are those riparian obligate species that are associated with high woody vegetation complexity and a riparian system in proper functioning condition (also see note 8 in Appendix 2, pg. 37). Included as riparian indicator species are Yellow-billed Cuckoos (*Coccyzus americanus*), Willow Flycatchers (*Empidonax traillii*), Common Yellowthroats (*Geothlypis trichas*), Wilson's Warblers (*Wilsonia pusilla*), Yellow-breasted Chats (*Icteria virens*), and Yellow Warblers (*Dendroica petechia*). Song Sparrows (*Melospiza melodia*), although an obligate species associated with woody vegetation complexity in this area, are not as "sensitive" to riparian habitat conditions and therefore are not considered an indicator species.

Thus, this report will summarize our 1999 and 2000 research activities and address the following issues: comparative summaries of bird and vegetation surveys on study sites, model analysis of bird-habitat relationships, study sites as riparian habitat for songbirds, and management implications of all results.

Implications

Focusing on characteristics of the riparian woody vegetation affected by livestock grazing and that indicate "proper functioning condition" of the riparian system, rather than the vegetation characteristics traditionally measured in bird-habitat studies, provides us with a common language that can be used by researchers and land managers. "Proper functioning condition (PFC) is an assessment tool which has been developed in cooperation with many individuals, interest groups, and state and federal agencies. It provides the *common language and communication tool* that invites participation from the widest group of affected interests..." (NRST 1997) [emphasis added]. Understanding the relationship between the riparian songbird community and characteristics of "proper functioning condition" can assist in appropriately directing management activities.

Therefore, assessing the relationship between riparian songbirds, and vegetation characteristics that are affected by livestock grazing and indicate "proper functioning condition", will enable us to examine the response of these species to the restoration of riparian process and function that can result from this grazing management strategy. And, by using the language that is used in directing management activities, we will be more effective in communicating with land managers the needs of riparian songbirds. A key distinction here is that the management of riparian restoration focuses on processes. An important effect of such management is the regeneration of woody vegetation in riparian areas, a result that only arises under proper functioning conditions. Songbirds, in turn, respond to woody vegetation in riparian areas. We stress that it is in the restoration of the complexity of woody vegetation that is the key to reversing the declines of the diverse songbird communities of the West. By collaborating with land managers employing criteria of proper functioning condition, like the BLM, we can provide a "birds'-eye-view" of such efforts. Understanding how the restoration of riparian areas facilitates the restoration of songbird communities is key to our approach.

Methods

Study Sites

Study sites were located in the counties of Crook, Wheeler, Grant, Deshutes, and Harney in Oregon. All study sites were located within the riparian zone. Upland habitat varied across all study sites and included the following general habitat types: sagebrush flats, shrub steppe, juniper woodlands, and mixed coniferous forest. See Appendix 6 for a description of study site locations and study site codes; see Appendix 7 for maps of the locations of each study site. Fourteen study sites were established in 1999, and seven new ones were established in 2000.

Avian Community Assessment

The avian community Birds were sampled at all study sites using standardized point count sampling methods. Protocol for conducting point counts followed Ralph et al. (1993). Point counts were conducted along a transect running parallel to the stream. Point count sample points were situated a minimum of 200 meters apart along this transect. Point counts were conducted on each site three times throughout the breeding season between May 31 and July 2 in 1999 and between May 28 and July 1 in 2000. Point counts started within one hour of sunrise and finished within four hours of sunrise. Each count involved counting all bird species seen and heard within a five-minute period. Individuals observed within a 50-meter radius of the point count sampling point were noted separately from those observed outside of a 50 meter radius.

Vegetation Assessment: 1999

Vegetation sampling was conducted on ten of the 14 study sites in 1999: BENO, BESO, BREA, BRNO, BRSO, CANO, CASO, MECA, MUCR, NECR. A greenline transect, defined by Cagney (1993) as "that specific area where a more or less continuous cover of vegetation is encountered when moving away from the center of an observable channel", was established at each bird sampling point. The greenline transect ran 100 meters along the stream, and initiated at a point on the streambank close to the point count sample point. Ten random points were selected along each greenline transect.

Streambank vegetation volume and structural diversity was evaluated using a point intercept sampling method adapted from Noon (1988). The presence of vegetation within four height classes was noted: 1) 0 – 0.5 m., 2) 0.5 – 1.0 m., 3) 1.0 – 2.0 m., and 4) 2.0 – 3.0 m.. Within each height class, the number of times (hits) that a plant touched a 1 ½" PVC pipe was counted. Vegetation was classified as either herbaceous, woody riparian or woody upland. Streambank vegetation was sampled within one meter of the waters edge at each of the ten random points along the greenline transect.

Riparian zone width measurements were taken on the 1st, 3rd, 5th, 7th, and 9th random points along the greenline transect. The width of the zone of continuous woody riparian vegetation was measured from the point closest to the streambank where woody vegetation is found (including any vegetation overhanging the water) through all continuous woody riparian vegetation including vines, shrubs and tree canopy. Vegetation was considered to be no longer continuous when a gap in woody riparian vegetation within one meter of a measuring tape was greater than five meters. Upland woody vegetation, e.g. sagebrush and juniper, was not included in the measurement. Along each of these width measurements, the composition of woody riparian species and the average height of the woody vegetation were determined.

At each sampling point, the number of trees within 100 meters was determined. Trees were counted within two categories: upland species and riparian associated species.

Vegetation Assessment: 2000

Vegetation sampling methods were modified slightly in 2000. Vegetation sampling was conducted on all ten of the study sites in 2000. In 2000, the greenline transect was 100 meters long, and was centered on the bird sampling point. Vegetation volume and structural diversity measurements were taken both along the streambank as in 1999, and within a patch of woody riparian vegetation. These measurements were taken at five points along the greenline transect: at the point count sampling point and at 25 and 50 meters in each direction. Streambank side that was sampled was randomly chosen. Streambank vegetation volume and structural diversity measurements were taken within one meter of the edge of water. Riparian patch measurements were taken in a patch of woody riparian vegetation within 10 meters of the edge of water. If the 10-meter mark fell within a woody vegetation patch, the measurement was taken there. If not, the nearest patch of woody vegetation greater than 0.5 meter tall and greater than 0.5 meter in diameter was determined, and the measurement was taken in the patch at least 1 meter from the edge of the patch. As in 1999, at each vegetation sample point, the number of hits of vegetation in each of four height classes was determined, 1) 0 – 0.5 m., 2) 0.5 – 1.0 m., 3) 1.0 – 2.0 m., and 4) 2.0 – 3.0 m.. Vegetation was classified as herbaceous, riparian woody (including green and woody parts of the plant), or upland woody (including green and woody parts of the plant).

Shrub and tree cover estimates were determined for a 50-meter radius around the point count sample point. Shrubs were defined as woody vegetation less than five meters in height. Trees were defined as woody vegetation greater than five meters in height. The total amount of area covered by shrubs and trees, and the amount of area covered by each species was determined. For example, a sample point could have cover estimates of 45% shrub cover, composed of 25% coyote willow (*Salix exigua*), 10% Wood's rose (*Rosa woodsii*), and 10% blue elderberry (*Sambucus cerulea*), and 5% tree cover, composed entirely of (i.e. 5%) western juniper (*Juniperus occidentalis*).

The average width of the zone of woody riparian vegetation within 50 meters on either side of the point count point was estimated from a series of measurements taken using a Buschnell Yardage Pro 500 range finder. The maximum width of the woody vegetation zone within 50 meters on either side of the point count point was determined using the range finder. Average height of the woody vegetation within 50 meters of the point count point was estimated from a series of measurements throughout the vegetation sampling plot.

In addition to the above vegetation measurements, the following information was recorded at each point count sampling point: a general description of the predominant riparian habitat type, i.e. wet meadow/herbaceous, willow dominated, alder dominated, etc; a general description of the predominant upland habitat type, i.e. sagebrush flat, ponderosa pine (*Pinus ponderosa*) forest, agricultural field, narrow canyon, juniper woodland, grazed range, etc; stream width, as measured at the sampling point; and stream orientation, defined as the cardinal direction of the downstream flow of water.

Analysis

Avian community assessment – Bird species lists were determined for each study site based on all observations made at any time on the study site, not just during point count sampling. For all other analyses and comparisons, only observations made during point count surveys, and within 50 meters of the sample point were included. Unless otherwise noted, only observations of riparian associated species were used in analysis. Species observed were classified as riparian associated species (i.e. riparian obligate and dependent species as defined by Partner's In Flight), and non-riparian associated species.

At each point count sample point, likely breeding status of each species was determined using the point count data. If a species was observed during only one of three sample times, then it was considered to be a possible breeder at the point. If a species was observed during at least two of three sample times, then it was considered to be a probable breeder at the point. To facilitate comparisons between study sites with different numbers of points, the average number of riparian associated species observed as possible and probable breeders per point were determined for each study site.

Vegetation assessment – For both the 1999 and 2000 streambank point intercept data, and the 2000 riparian patch point intercept data, vegetation volume was calculated as the total number of hits across all height classes and vegetation structural diversity was calculated using the Shannon-Weiner diversity index. The Shannon-Weiner diversity index measures the relative abundances of hits within height classes and evaluates the evenness of hits across all height classes. Higher values for the vegetation structural diversity index indicate greater numbers of hits in each height class, and an even distribution of hits across the height classes.

Tree abundance measurements for 1999 were categorized into two groups: all tree abundance and riparian tree abundance. For the 2000 data, shrub and tree cover estimates were summarized by species and for various vegetation groups including woody riparian species, woody upland species, all *Salix* species, and all *Populus* species. The riparian woody vegetation group included those species associated with the riparian zone. The upland woody vegetation group included those species associated with the xeric uplands. See Appendix 3 for species included in these groups. Average vegetation characteristics were determined for each study site for both the 1999 and 2000 data.

Bird-habitat model analysis - Bird-habitat model analysis was conducted to examine how the riparian songbird community was related to the measured vegetation characteristics. We predicted that riparian habitat with greater woody vegetation complexity, i.e. with a vegetative state indicating proper functioning condition, would have a greater number of riparian associated bird species.

1999 and 2000 data were analyzed separately because of the different vegetation sampling methods, and possible yearly variations. Two dependent or response variables were examined for each year: the average number of all riparian associated species observed as probable breeders, and the average number of obligate riparian associated species observed as probably breeders. We included only individuals observed as probable breeders to eliminate those using the habitat while passing through on migration.

Analysis was conducted using a set of candidate models to describe bird-habitat associations for each dependent variable, i.e. all species and obligate species, and for each year. The benefit of conducting habitat model analysis with a set of candidate models, rather than only a single habitat model, is that the best-fitting model of the group of candidate models can be determined, rather than simply the fit of a single, given model.

To develop the set of candidate models, we first ran multiple regression analysis on each independent variable or covariate using a significance level of α=0.15 to determine which covariates should be included in the models. Based on this analysis five covariates were included in the 1999 models (average width of the woody riparian vegetation, average height of the riparian shrub vegetation, average vegetation structural diversity, average vegetation volume, and average riparian tree abundance) and six covariates were included in the 2000 models (average width of the woody riparian vegetation, average height of the riparian shrub vegetation, average percent cover of riparian shrub vegetation, average percent cover of riparian tree vegetation, average number of riparian tree species, and average riparian patch vegetation structural diversity). Based on biological information and taking into account correlations among the selected covariates, ten models were developed for the 1999 data (table 1) and 13 models for the 2000 data (table 2). Covariates were not included in the same model if they had a correlation greater than r=0.75. In 1999, two independent variables were natural log transformed to ensure normality: average width of woody riparian vegetation and riparian tree abundance. In 2000, average cover of riparian tree vegetation was natural log transformed to meet the assumption of normality. Multiple regression analysis was conducted and R^2 values, Akaike's corrected Information Criterion (AICc) values, and Bayesian posterior probabilities were determined for each model. Within each set of candidate models, the model with the highest R^2, the lowest AICc, and the highest Bayesian posterior probability was selected as the best model, from the set of candidate models, that fit the data.

Table 1. 1999 Bird-habitat candidate models

Average number of all/obligate riparian species observed as probable breeders per point ~
1. average width of the woody riparian vegetation
2. average riparian shrub height
3. average width + average vegetation structural diversity
4. average width + average vegetation volume
5. average riparian shrub height + average vegetation volume
6. average width + average riparian tree abundance
7. average riparian shrub height + average riparian tree abundance
8. average width + average riparian tree abundance + average vegetation structural diversity
9. average width + average riparian tree abundance + average vegetation volume
10. average riparian shrub height + average riparian tree abundance + average vegetation volume

Table 2. 2000 Bird-habitat candidate models

Average number of all/obligate riparian species observed as probable breeders per point ~
1. average width of the woody riparian vegetation
2. average riparian shrub height
3. average riparian shrub percent cover
4. average riparian tree percent cover
5. average number of riparian tree species
6. average riparian patch vegetation structural diversity
7. average riparian shrub height + average riparian shrub percent cover
8. average width + average riparian patch vegetation structural diversity
9. average riparian shrub height + average riparian shrub cover + average riparian tree cover
10. average riparian shrub height + average riparian shrub cover + average riparian vegetation structural diversity
11. average riparian shrub cover + average riparian tree cover + average number of riparian tree species
12. average width + average riparian tree cover
13. average width + average riparian tree cover + average number of riparian tree species

Results

Avian Community Assessment

A total of 70 avian species were observed across all study sites in 1999, and a total of 74 avian species were observed across all study sites in 2000 (appendices 4 and 5). In 1999, 15 riparian associated species were observed across all study sites, including ten dependents and 5 obligates. These counts do not include Bank Swallows (*Riparia riparia*), Tree Swallows (*Tachycineta bicolor*) and Belted Kingfishers (*Ceryle alcyon*). These species are identified as riparian dependents or obligates because they are associated with water but they are not associated with the woody riparian habitat that is of interest in this study. In 2000, 17 riparian associated species were observed across all study sites, including 12 dependent species and five obligate species. Not included in these counts were Bank Swallows, Tree Swallows, Belted Kingfishers and American Dippers (*Cinclus mexicanus*), species primarily associated with the water and not the associated riparian habitat. As well, single observations of a Cooper's Hawk (*Accipiter cooperii*) and a Bald Eagle (*Haliaeetus leucocephalus*) are not included.

Riparian dependent and riparian obligate species observed as probable breeders at all study sites in 1999 are given in tables 3 and 4 respectively. On five of 14, and seven of 14 study sites no riparian dependent or riparian obligate species respectively were observed as probable breeders.

Riparian dependent and riparian obligate species observed as probable breeders on all study sites in 2000 are given in tables 5 and 6 respectively. Every study site had at least two riparian dependent species, and BRSO, DUBS and TEMI each had a maximum of four species. On only one study site, BEAR, were no obligate species observed, whereas all four obligate species were observed on DUBS.

Vegetation Assessment: 1999

Average observed vegetation characteristics for study sites in 1999 are given in table 7. It should be noted that because of the sampling methods used, it is likely that all values for width and height are underestimated. First, width measurements were taken on only one side of the stream and therefore underestimate the total width of woody vegetation in the riparian zone at a given point. Second, because of the placement of a limited number of random sample points, measurements were often taken in areas unrepresentative of the entire vegetation sampling area, and likely do not accurately reflect actual woody vegetation width and height around a bird sampling point. Based on personal observation, it is believed that these values are underestimated and therefore it may be more appropriate to examine the maximum widths and heights measured.

Table 3. Riparian dependent species observed at study sites in 1999. Species are classified as possible breeders (X) when observed during at least one point count survey and as probable breeders (PB) when observed during at least two point count surveys. Al observations are within 50 meters of the observer. See text for definition of riparian dependent species. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Western Wood Pewee	Eastern Kingbird	House Wren	Black-headed Grosbeak	Lazuli Bunting	Bullock's Oriole	American Goldfinch
BEAN	10			X			X	
BEAS	10			PB			X	
BENO	9			X				
BESO	9			PB		X	X	
BREA	12	PB			PB	X	PB	PB
BRNO	19	X	X	X	X	X	PB	X
BRSO	13	PB			X	PB	PB	X
BRWE	6						X	
CANO	13							
CASO	12							
MECA	7	X					PB	
MUCR	14	X				PB	X	PB
NECR	11	X				PB	X	

Table 4. Riparian obligate species observed at study sites in 1999. Species are classified as possible breeders (X) when observed during at least one point count survey and as probable breeders (PB) when observed during at least two point count surveys. Al observations are within 50 meters of the observer. See text for definition of riparian obligate species. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Common Yellowthroat	Yellow Warbler	Yellow-breasted Chat	Song Sparrow
BEAN	10				
BEAS	10				
BENO	9				PB
BESO	9				PB
BREA	12	X	PB	X	PB
BRNO	19			X	X
BRSO	13		PB		PB
BRWE	6				
CANO	13				
CASO	12				X
MECA	7				PB
MUCR	14				PB
NECR	11				

Table 5. Riparian dependent species observed at study sites in 2000. Species are classified as possible breeders (X) when observed during at least one point count survey and as probable breeders (PB) when observed during at least two point count surveys. Al observations are within 50 meters of the observer. See text for definition of riparian dependent species. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Lewis' Woodpecker	Western Wood Pewee	Warbling Vireo	House Wren	Black-headed Grosbeak	Lazuli Bunting	Bullock's Oriole	American Goldfinch
BEAR	8		PB		X		X	X	PB
BREA	12		PB			X		PB	X
BRNO	18		X			X	PB	PB	X
BRSO	13		PB			X	PB	PB	X
DUBS	10		PB			X	PB	PB	X
SJDA	13		PB	X		X	PB	X	X
SJDB	11	X	X		X	X	PB	X	
SJDC	9	PB					PB	X	
SJDD	10		X	X			PB	PB	
TEMI	10						PB	PB	PB

Table 6. Riparian obligate species observed at study sites in 2000. Species are classified as possible breeders (X) when observed during at least one point count survey and as probable breeders (PB) when observed during at least two point count surveys. Al observations are within 50 meters of the observer. See text for definition of riparian obligate species. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Common Yellowthroat	Wilson's Warbler	Yellow Warbler	Yellow-breasted Chat	Song Sparrow
BEAR	8					X
BREA	12			PB	PB	PB
BRNO	18			PB	X	PB
BRSO	13		X	PB		PB
DUBS	10	PB		PB	PB	PB
SJDA	13			PB	X	PB
SJDB	10			PB	X	PB
SJDC	9			X		PB
SJDD	9			PB	X	PB
TEMI	10				PB	

Streambank vegetation structural diversity measurements show gross differences in vegetation structure among study sites, but do not differentiate among subtler differences. All study sites in meadow riparian systems (BENO, BESO, CANO and CASO) had lower streambank vegetation structural diversity indices than those study sites in woody shrub riparian systems (BREA, BRSO, BRNO, MECA, MUCR, NECR). Note that this differentiation is not made in the streambank vegetation volume measurement.

Table 7. Mean (±SE) vegetation characteristics at study sites in 1999. See text for description of characteristics. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Riparian Tree Abundance	Average Width	Average Shrub Height	Maximum Width	Maximum Shrub Height	Streambank Vegetation Volume	Streambank Vegetation Structural Diversity
BENO	9	0	0.234±0.13	0.09±0.04	1.13±0.59	0.40±0.17	12.54±0.85	0.11±0.04
BESO	9	0	0.15±0.10	0.09±0.05	0.58±0.40	0.27±0.14	11.9±90.77	0.28±0.06
BREA	11	3.82±1.77	11.44±3.57	1.96±0.29	25.88±10.18	3.23±0.38	10.67±1.13	0.69±0.09
BRNO	19	11.37±9.70	6.93±2.27	1.14±0.152	15.21±4.21	2.18±0.29	11.21±0.67	0.43±0.07
BRSO	13	0.24±0.17	5.05±1.01	1.49±0.18	11.68±2.39	2.39±0.25	12.96±1.07	0.61±0.05
CANO	13	0	0.002±0.002	0.002±0.002	0.021±0.021	0.021±0.02	4.592±0.594	0.023±0.015
CASO	12	0.42±0.15	0.46±0.19	0.10±0.03	2.66±1.02	0.52±0.13	7.88±0.64	0.13±0.03
MECA	6	0.83±0.54	2.16±0.55	1.29±0.24	4.68±0.76	3.21±0.50	15.58±0.71	0.71±0.09
MUCR	10	4.40±2.41	1.29±0.37	0.76±0.20	4.94±1.32	2.33±0.52	9.40±0.89	0.43±0.11
NECR	8	0.75±0.37	2.20±0.66	0.88±0.27	6.70±1.38	2.38±0.45	9.26±1.41	0.63±0.11

Vegetation Assessment: 2000

Mean measurements of woody vegetation at study sites in 2000 are given in table 8. Riparian patch vegetation volume and vegetation structural diversity measurements were overall higher than those for the streambank. For both the streambank and the riparian patch, BEAR had consistently low measurements.

2000 average cover estimates for woody riparian vegetation groups are given in table 9. Trees are defined as individuals greater than five meters in height and shrubs are individuals less than five meters in height. Study sites on the South Fork of the John Day River (SJDA – D) had consistently higher riparian shrub cover than any of the other study sites. The average number of riparian woody species observed at study sites in 2000 is shown in table 10. Three of the four study sites on the South Fork of the John Day River (SJDA, C, D) had at least nine different riparian shrub species, higher than the four to seven observed on other study sites. 2000 average cover estimates for different woody riparian species are given in table 11. The highest average cover estimate of a woody riparian species was found at BREA where *Salix* sp. shrubs covered 25.5 percent of the sampling area.

Table 8. Mean (±SE) woody vegetation characteristics at study sites in 2000. See text for description of characteristics. See Appendix 6 for study site codes. Width measurements include woody vegetation on both sides of the stream within 50 meters of the sample point, but do not include measured stream widths.

Study Site	Number of Sample Points	Stream Width	Average Shrub Height	Average Width	Maximum Width	Riparian Patch Vegetation Volume	Riparian Patch Vegetation Structural Diversity	Streambank Vegetation Volume	Streambank Vegetation Structural Diversity
BEAR	8	4.48±0.55	1.50±0.21	7.09±3.01	19.53±5.84	16.58±1.23	1.12±0.14	4.95±0.57	0.39±0.09
BREA	12	3.77±0.24	2.31±0.13	20.82±5.61	44.98±7.82	17.12±0.95	1.32±0.05	10.75±1.76	0.93±0.13
BRNO	19	5.27±0.32	2.24±0.12	12.51±2.95	33.68±7.13	14.84±1.09	1.35±0.06	7.91±0.73	0.81±0.06
BRSO	13	4.30±0.40	2.13±0.13	17.24±3.18	31.62±3.93	19.91±1.64	1.38±0.06	6.92±0.39	0.58±0.07
DUBS	10	18.34±1.55	3.30±0.17	38.16±8.26	76.66±12.5	20.14±1.43	1.45±0.08	8.35±0.92	0.62±0.14
SJDA	13	11.90±1.30	2.42±0.14	35.41±4.04	61.18±7.28	15.93±1.41	1.34±0.05	8.13±1.30	0.60±0.12
SJDB	10	11.45±0.87	2.70±0.13	48.05±5.60	76.05±8.05	19.03±1.75	1.47±0.06	12.42±0.90	1.13±0.08
SJDC	9	11.06±1.63	2.03±0.07	16.50±3.44	52.83±7.07	14.26±1.69	1.31±0.07	10.74±1.07	1.13±0.13
SJDD	9	8.08±0.61	2.22±0.15	29.70±5.28	56.03±5.41	17.85±1.29	1.52±0.04	7.89±0.70	0.52±0.12
TEMI	10	2.51±0.26	2.05±0.24	18.19±5.15	31.19±5.53	18.74±1.42	1.33±0.06	9.88±1.28	0.91±0.09

Table 9. Mean (±SE) percent cover of woody vegetation groups at study sites in 2000. See Appendix 6 for study site codes. See Appendix 3 for species included in each group.

Study site	Number of Sample Points	Riparian - trees	Riparian - shrubs	Upland - trees	Upland - shrubs
BEAR	8	1.75±1.61	6.25±1.88	9.63±1.44	18.13±8.16
BREA	12	0.50±0.29	29.17±5.01	1.17±0.56	9.75±5.05
BRNO	19	0.50±0.25	16.06±3.10	0.72±0.29	36.94±6.26
BRSO	13	1.08±0.42	24.54±4.30	22.92±4.89	35.38±6.49
DUBS	10	10.60±3.75	44.00±5.29	19.50±2.93	9.20±2.72
SJDA	13	14.00±2.98	55.00±3.59	13.69±2.19	10.69±2.28
SJDB	10	3.70±1.31	69.30±3.30	4.20±1.84	0.50±0.50
SJDC	9	1.56±0.56	39.33±2.39	42.56±3.04	1.56±0.53
SJDD	9	5.44±1.80	40.22±6.77	20.67±3.54	3.89±1.23
TEMI	10	1.50±1.19	18.00±4.90	17.80±5.61	32.50±7.01

Table 10. Mean (±SE) species richness (i.e. number of species) of all woody riparian species and all *Salix* species at study sites in 2000. See Appendix 6 for study site codes. See Appendix 3 for list of species included in riparian species.

Study Site	Number of Sample Points	Riparian - trees	Riparian - shrubs	Salix - trees	Salix - shrubs
BEAR	8	0.25±0.16	5.00±0.46	0.00	1.50±0.27
BREA	12	0.25±0.13	4.58±0.51	0.00	1.33±0.14
BRNO	19	0.39±0.16	4.06±0.42	0.17±0.09	1.67±0.21
BRSO	13	0.54±0.22	6.46±0.65	0.31±0.13	1.54±0.27
DUBS	10	1.60±0.43	7.50±0.54	0.90±0.31	1.90±0.23
SJDA	13	2.31±0.21	9.23±0.39	0.62±0.14	1.69±0.17
SJDB	10	1.00±0.21	6.70±0.3	0.20±0.13	0.80±0.13
SJDC	9	1.00±0.33	9.44±0.53	0.22±0.15	0.56±0.18
SJDD	9	1.22±0.36	10.44±0.44	0.22±0.15	1.89±0.11
TEMI	10	0.30±0.15	5.40±0.69	0.10±0.10	1.10±0.31

Table 11. Mean (±SE) percent cover of woody riparian vegetation species at study sites, 2000. See Appendix 6 for study site codes.

Study Site	Number of Sample Points	Common Chokecherry	Red Birch	Red-osier Dogwood	Black Cottonwood - trees	Black Cottonwood - shrubs	Salix sp. - trees	Salix sp. - shrubs
BEAR	9	0.00	5.25±2.12	0.00	0.00	0.00	0.00	2.00±0.63
BREA	9	0.25±0.13	0.08±0.08	0.00	0.50±0.29	0.33±0.19	0.00	25.50±4.17
BRNO	11	0.00	0.00	0.00	0.00	0.28±0.28	0.22±0.13	14.67±2.78
BRSO	19	0.00	1.46±0.68	0.69±0.26	0.00	0.46±0.39	0.62±0.29	20.08±2.81
DUBS	13	4.50±2.41	17.00±4.22	5.20±2.49	0.00	0.00	4.60±1.86	18.50+4.17
SJDA	13	1.62±0.77	10.46±3.06	8.15±1.15	4.92±1.36	1.08±0.63	1.62±0.45	19.31±1.80
SJDB	12	1.10±0.77	4.80±1.72	16.00±1.45	0.00	0.00	0.80±0.55	8.00±3.55
SJDC	9	3.11±0.81	6.22±1.75	10.22±1.85	0.00	0.00	0.22±0.44	1.53±1.59
SJDD	10	3.78±1.45	13.11±2.71	7.33±2.30	0.00	0.33±0.17	0.33±0.24	9.11±1.98
TEMI	8	0.50±0.50	1.80±1.28	0.00	0.00	0.00	0.20±0.20	5.30±2.57

Bird-Habitat Model Analysis

In 1999, for both dependent variables (all riparian species and obligate riparian species) model number two had the lowest AICc (i.e. lowest deviance of the data from the model) and had the highest posterior probability (i.e. likelihood of that model being the best model to describe the data given the set of candidate models). Model two included only the covariate average height of the riparian shrub vegetation. For both "all species" and "obligates only" analysis, model number two did not have the highest R^2 value. But, based on AICc values and posterior probabilities, no other model was close to being competitive with model two as top model, i.e. AICc values and posterior probabilities were significantly higher and lower respectively for all other models.

In 2000, for both dependent variables, "all riparian species" and "obligate riparian species", model number one had the lowest AICc, and the highest posterior probability. Model one included only a single covariate: average width of the woody riparian zone. Again, for both "all species" and "obligates only" analysis, model number one did not have the highest R^2 value but did have a significantly lower AICc and higher posterior probability than all the other models.

Conclusions

Bird-Habitat Model Analysis

Bird-habitat model analysis indicates that both the average width of the woody riparian zone, and the average height of the riparian shrub vegetation are the best predictor of the number of riparian associated species, both obligates and dependents, that are found in a given area (figures 1-4).

Figures 1 and 2 show how the number of riparian species observed, all species and obligates alone respectively, increases as the height of riparian shrubs increases. Figures 3 and 4 show how the number of riparian species observed, all species and obligates alone respectively, increases as the width of the woody riparian zone increases. Therefore, model analysis supports the prediction that riparian birds are positively responding to characteristics indicating proper functioning condition and increasing woody vegetation complexity.

It should be noted that in 1999, average height was strongly correlated (r>0.85) with average width and vegetation structural diversity. And in 2000, average width was strongly correlated (r>0.75) with average height of riparian shrub vegetation and riparian shrub percent cover, and moderately correlated (r>0.60) with riparian patch vegetation structural diversity, riparian tree species richness, and riparian tree percent cover. Therefore, although model analysis indicates that a single vegetation characteristic is the most important, the increasing number of riparian species observed may in fact be associated with a correlate of that characteristic. For example, areas with a wider woody riparian zone, and a taller shrub component, will generally also have greater overall shrub and tree cover, a greater number of different woody riparian species, and a greater structural complexity of the woody vegetation. Therefore, the higher riparian bird species richness could be associated with any of these characteristics.

Figure 1. Relationship between the average height of riparian shrubs (m) and the average number of all riparian species observed as probable breeders on study sites in 1999. Regression model: Average number of all riparian species = 0.0508 + 0.6249* average riparian shrub height (R^2=0.6047; P<0.0081).

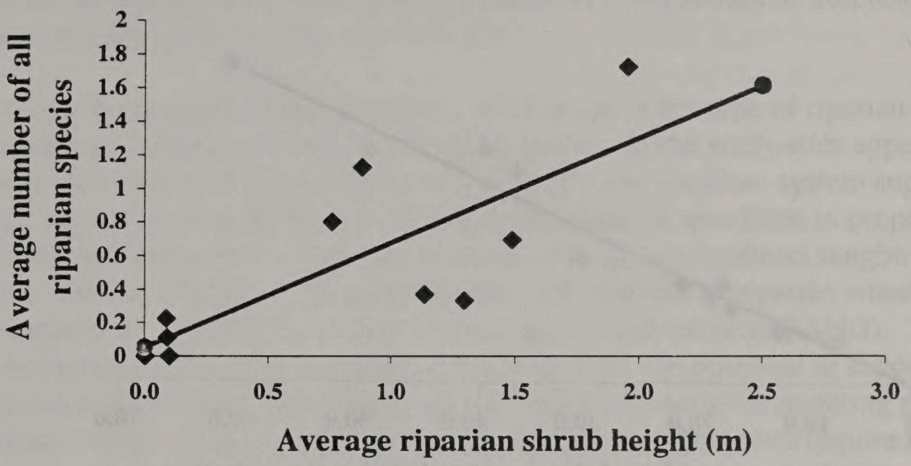


Figure 2. Relationship between the average height of riparian shrubs (m) and the average number of obligate riparian species observed as probable breeders on study sites in 1999. Regression model: Average number of obligate riparian species = -0.0312 + 0.2943* average riparian shrub height (R^2=0.5157; P<0.0193)

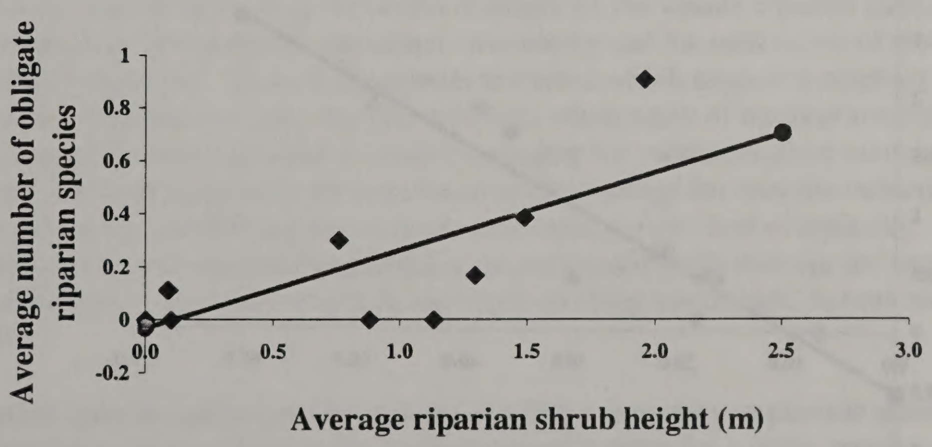


Figure 3. Relationship between the average width of the woody riparian zone (m) and the average number of all riparian species observed as probable breeders on study sites in 2000. Regression model: Average number of all riparian species = -0.0708 + 0.0629* average woody riparian zone width (R^2=0.9253 ; P<0.00009).

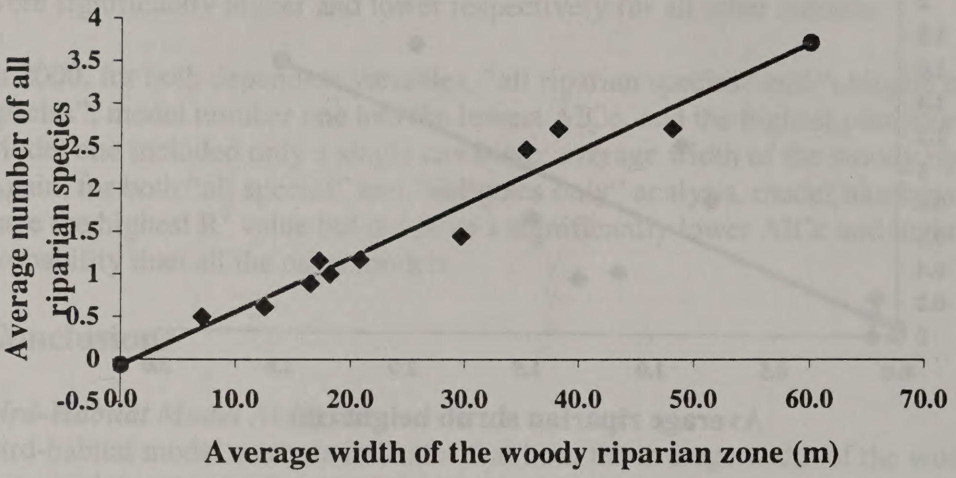
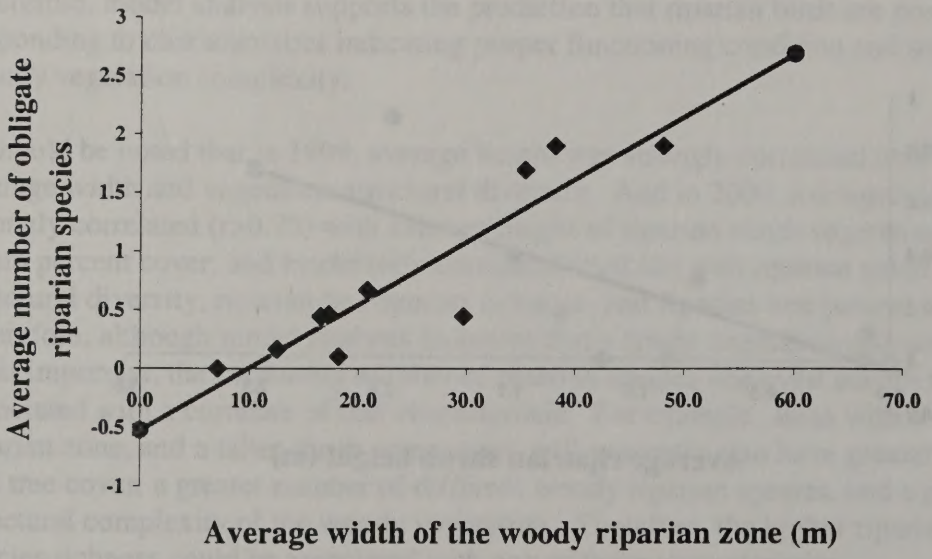


Figure 4. Relationship between the average width of the woody riparian zone (m) and the average number of obligate riparian species observed as probable breeders on study sites in 2000. Regression model: Average number of obligate riparian species = -0.5268 + 0.0535* average woody riparian zone width (R^2=0.8407 ; P<0.0002).



Study Sites as Riparian Habitat for Songbirds

To assist local land managers, we conducted a qualitative assessment of the current potential of study sites to provide habitat for riparian songbirds. This was done by evaluating the condition of the riparian habitat through the presence or absence of riparian indicator songbirds, and through the measured characteristics of woody vegetation complexity. A qualitative description of the riparian habitat at each study site, an overview of the riparian songbirds observed on each site, and an evaluation of each study site as habitat for riparian songbirds is given in Appendix 6. Representative pictures of each study site are also included.

In evaluating the study sites, we found a great range in the type of riparian habitat surveyed and the condition of each riparian system. Some study sites appeared to be meeting their full potential, whether as a primarily wet meadow system supporting little woody vegetation (e.g. BESO), or as a complex riparian woodland in proper functioning condition and fully meeting the habitat needs of riparian woodland songbirds (e.g. SJDA). Several sites were not meeting their full potential as riparian woodland habitat for songbirds (e.g. BRNO), or even as wet meadow habitat (e.g. CANO). Thus, we feel that management activities on many of the sites (with the potential to support riparian woodland habitat) have been moderately to highly successful in restoring riparian woodland habitat for songbirds. However, we feel that some sites require further management, whether through greater time or different management strategies, to fully restore the woody vegetation complexity needed along the length of the study site.

Management Implications

Based on the bird-habitat model analysis it is reasonable to suggest that management for increasing width of the woody riparian zone, and increasing height of riparian shrub vegetation, may assist in increasing the number of riparian associated songbird species, both dependents and obligates, found at a given study site, regardless of whether the response is due to the increasing width or height, or to a related vegetation characteristic. But, to ensure restoration of all components of riparian bird habitat, management should focus not just on increasing the width or height of the woody riparian zone, but also on increasing the diversity, the structural complexity and the total cover of the woody riparian vegetation. Thus, management activities which support a complex and diverse riparian woodland will also support a diverse community of riparian songbirds. Again, we emphasize the distinction between managing for processes (here associated with proper functioning condition) and attempting to manage for specific outcomes. We argue that managing for PFC results in increasing woody vegetation complexity. We stress that management does not (and realistically cannot) specifically manage for vegetation width, for example, as that only comes as the result of many interrelated factors arising from PFC.

Species-specific habitat model analysis would be necessary to provide statistically supported recommendations for management of habitat for a given species. Our emphasis, instead, is the tie between management for PFC, and the general benefits that arise for songbird restoration. We can describe the particular requirements for each species, but recognize they all result, in different sites with different responses of both vegetation and birds, to PFC management. However, examination of the habitat requirements of various riparian species does suggest broad management recommendations. First, several species are noted to be associated with dense thickets of riparian vegetation including Yellow Warblers, Yellow-breasted Chats, Wilson's Warblers, Willow Flycatchers, and Black-headed Grosbeaks. The first four of these are excellent indicators of riparian habitat in good condition. Therefore, management should target increasing the complexity and diversity of woody riparian vegetation, particularly the understory. Second, several species, including Western Wood Pewees, Bullock's Orioles, and Lewis' Woodpeckers, require older, tall trees and snags in riparian areas. Management and restoration activities should be targeted in areas with these features, and to maintain any mature cottonwoods, or Ponderosa Pines (which are used by Lewis' Woodpeckers). Third, two species were conspicuously absent from many or all of the study sites, Common Yellowthroats and Willow Flycatchers, both of which are excellent indicators of riparian habitat in good condition. Willow Flycatchers were not observed on any study sites, but were observed on the Blitzen River by biologists from the Point Reyes Bird Observatory (PRBO; A. Holmes, personal communication), downstream from the Donner und Blitzen River study site (DUBS). Common Yellowthroats were found only on the Donner und Blitzen River study site in areas with standing water and thick, emergent, herbaceous riparian vegetation such as cattails (*Typha* sp.). Both Common Yellowthroats and Willow Flycatchers are described by Csuti et al. (1997) to be associated with riparian shrubs and thickets in marsh or wet meadow habitat. Management activities for these species could target the restoration of marsh and wet meadow habitat by increasing flooding and standing water in the riparian zone. Many factors are known to lower the water table in the riparian zone, including removal of riparian vegetation and bank soil compaction by livestock and human activities (Belsky et al. 1999).

Another historical explanation for the loss of marsh riparian habitat in the West is the decline in beaver activity in these areas (McKinstry et al. 2000). Loss of beaver in the riparian systems of the West has been cited as a major influence on the change of vegetative characteristics in these systems. Beaver activities in riparian systems create and maintain wetlands, alter the movements of water, nutrients and sediment in the system, and influence the structure and composition of the riparian vegetative and animal community (McKinstry et al. 2000). As an architect of riparian systems, it is instrumental in the development of riparian habitat, including the marsh and wet meadow habitat that results when flooding occurs from dam building activities. Therefore, management activities that naturally promote restoration of marsh and wet meadow habitat, including increasing beaver activity and decreasing livestock grazing in riparian zones, may assist in providing habitat for riparian songbird species, including Common Yellowthroats and Willow Flycatchers.

The results from our research support the prediction that the riparian songbird community is negatively affected by those changes in the woody vegetation complexity that result from traditional livestock grazing management. In their review of livestock influences on riparian systems, Belsky et al. (1999) note that livestock grazing results in decreased herbaceous cover and diversity, decreased shrub and tree cover and diversity, simplified vertical and horizontal structure, a loss of larger shrubs and trees, and an overall reduction in the riparian area. These are all characteristics of the riparian habitat that we found to be positively associated or correlated with an increasingly complex riparian songbird community. Thus, livestock grazing management practices which negatively affect these features of woody vegetation complexity will also negatively affect the riparian songbird community.

As well as demonstrating the negative relationship between the songbird community and changes in woody vegetation complexity that can result from grazing practices, this research also demonstrates that the opposite relationship can occur with appropriate management activities. Specifically, our research demonstrates that the riparian songbird community is *positively* affected by the increases in woody vegetation complexity that resulted from management activities on many of these systems in central Oregon. Thus, this research allows us to demonstrate that restoration of riparian habitat critical to songbirds is possible for alternative livestock grazing management strategies as long as management is guided by those characteristics of the riparian woodland habitat that are affected by livestock grazing, and that are important to riparian songbirds.

This research has also allowed us to identify easily measured and easily communicated vegetation features which are affected by grazing management practices, and which are important to riparian songbirds. These simple vegetation requirements, i.e. woody vegetation width and height, provide land managers with tangible targets for management, and can assist managers in setting priorities for land conservation and restoration.

Future Research Needs

There are several directions needed for future research activities. First, landscape level analysis should be conducted to enhance our understanding of the effects of patch size, habitat continuity, and adjacent land use. Landscape level effects of habitat loss have been well studied on the declining songbird populations in fragmented forest habitat in the east (e.g. Ambuel and Temple, 1983; Freemark and Merriam, 1986). In the West, Saab (1999) found landscape level effects to be the most important influence on the riparian songbird community in southeastern Idaho. However, these effects have not been thoroughly examined for riparian habitat loss across other regions of the West. Thus, our efforts to understand the effects of riparian management and restoration on conserving riparian songbird populations requires an understanding of the effects of habitat loss across the landscape.

Second, conservation of songbird populations will not be achieved by simply ensuring appropriate habitat is available for occupancy, but requires successful reproduction, and therefore an understanding of those features of the habitat that affect breeding productivity. Songbird breeding productivity is affected by levels of nest depredation and by levels of nest parasitism by Brown-headed Cowbirds (*Molothrus ater*), which are in turn affected by features of the habitat at the local and landscape scale (RHJV 2000). Thus, effective conservation of riparian songbird populations will include successful reproduction in managed riparian habitat, and requires an understanding of the effects management and restoration efforts have on nest productivity and survivorship of riparian songbirds.

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Appendix 1. "Proper Functioning Condition" Criteria and Checklist (from Prichard, D. 1995. Riparian area management – process for assessing proper functioning condition. Bureau of Land Management. BLM/SC/ST-93/003+1373+REV95, Service Center, CO. 51 pp.)

(front)

Standard Checklist

Name of Riparian-Wetland Area: ______________________________

Date: ________ Area/Segment ID: ________________ Miles: __________

ID Team Observers: ______________________________

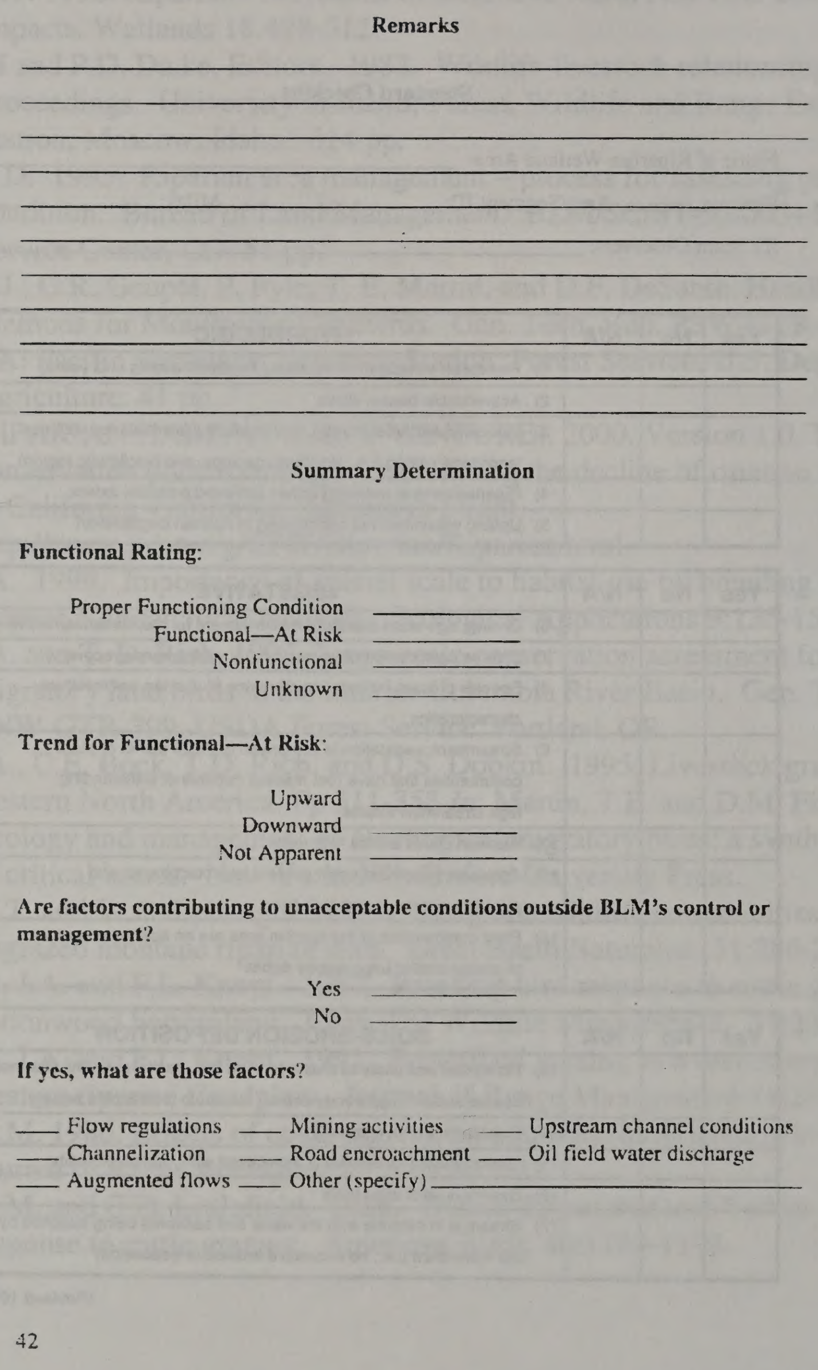
Yes	No	N/A	HYDROLOGIC
			1) Floodplain inundated in "relatively frequent" events (1-3 years)
			2) Active/stable beaver dams
			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			4) Riparian zone is widening or has achieved potential extent
			5) Upland watershed not contributing to riparian degradation

Yes	No	N/A	VEGETATIVE
			6) Diverse age-class distribution (recruitment for maintenance/recovery)
			7) Diverse composition of vegetation (for maintenance/recovery)
			8) Species present indicate maintenance of riparian soil moisture characteristics
			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			10) Riparian plants exhibit high vigor
			11) Adequate vegetative cover present to protect banks and dissipate energy during high flows
			12) Plant communities in the riparian area are an adequate source of coarse and/or large woody debris

Yes	No	N/A	SOILS-EROSION DEPOSITION
			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody debris) adequate to dissipate energy
			14) Point bars are revegetating
			15) Lateral stream movement is associated with natural sinuosity
			16) System is vertically stable
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1995)

(back)



Remarks

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Summary Determination

Functional Rating:

Proper Functioning Condition ________
Functional—At Risk ________
Nonfunctional ________
Unknown ________

Trend for Functional—At Risk:

Upward ________
Downward ________
Not Apparent ________

Are factors contributing to unacceptable conditions outside BLM's control or management?

Yes ________
No ________

If yes, what are those factors?

___ Flow regulations
___ Channelization
___ Augmented flows
___ Mining activities
___ Road encroachment
___ Other (specify) ____________________
___ Upstream channel conditions
___ Oil field water discharge

Appendix 2. Annotated summary of riparian bird species of eastern Oregon[1].

Riparian Dependents[2]:

Swainson's Hawk – *Buteo swainsoni*[3]
Swainson's Hawks are commonly associated with open country scattered with trees, including grasslands, sagebrush flats, juniper woodlands, and large meadows and grasslands within forested areas[4]. They require a tree for nesting, often a willow or juniper in this region. This species has been identified as requiring conservation action in the Great Basin region[5].
State Status – Sensitive[6]

Cooper's Hawk – *Accipiter cooperii*[3]
Cooper's Hawks are found in coniferous and deciduous forests, less frequently in juniper woodlands, and are often associated with riparian areas in forests.
State Status - None

Northern Goshawk – *Accipiter gentiles*
Northern Goshawks are primarily coniferous forest birds in Oregon. They prefer large stands of late-successional forest. This species has been identified as requiring conservation action in the Great Basin region.
State Status – Sensitive

Black-chinned Hummingbird – *Archilochus alexandri*
Habitat associations include the riparian woodlands, arid scrub, wooded canyons, open woodlands, and mountain chaparral of eastern Oregon. This species is often associated with woody vegetation along streams.
State Status – None

Calliope Hummingbird – *Stellula calliope*
The Calliope Hummingbird is primarily a middle elevation, mountain hummingbird that is commonly associated with riparian habitat, open forests, meadow edges, and willow and alder thickets in forested areas.
State Status - None

Lewis' Woodpecker – *Melanerpes lewis*
This woodpecker is primarily associated with the cottonwood riparian woodlands of the river valleys of eastern Oregon. Ponderosa pines and cottonwoods along rivers and streams are using as nesting and food storage trees. Declines in Lewis' Woodpecker populations in eastern Oregon have been attributed to loss of nesting and food storage trees, and to competition for cavities with European Starlings. This species was reported by two studies to respond positively livestock grazing (Saab et al. 19xx). The current distribution of Lewis' Woodpeckers in eastern Oregon is patchy and limited to small geographic areas. This species has been identified as requiring conservation action in the Great Basin region.
State Status - Sensitive

Red-naped Sapsucker – *Sphyrapicus nuchalis*
The Red-naped Sapsucker is associated with coniferous forests that include aspen stands or other riparian woodlands. Aspens are the preferred nesting trees.
State Status - None

Western Wood-pewee – *Contopus sordidulus*
This flycatcher is generally associated with forests and woodlands. In eastern Oregon it is often associated with riparian woodlands and aspen groves.
State Status - None

Eastern Kingbird – *Tyrannus tyrannus*
A bird of open and riparian woodlands, the Eastern Kingbird is also found in trees bordering open fields or agricultural land. In eastern Oregon, it has a limited and patchy distribution.
State Status - None

Warbling Vireo – *Vireo gilvus*
The Warbling Vireo is found in open deciduous and riparian woodlands, including alder, aspen and cottonwood stands. It has a patchy distribution in eastern Oregon.
State Status - None

Red-eyed Vireo – *Vireo olivaceus*
This vireo is limited primarily to north-eastern Oregon, with scattered occurrences in the rest of eastern Oregon. It prefers riparian habitat and is most commonly found in large stands of mature cottonwoods, but is also associated with alder, aspen and willow woodlands with large trees.
State Status – None

Bank Swallow – *Riparia riparia*
The Bank Swallow is found in open habitat near water. It digs a nest tunnel in dirt embankments, often the vertical side of streambanks.
State status – Sensitive

Tree Swallow – *Tachycineta bicolor*
Tree Swallows are also found in open country near water, including marshes, farm ponds, lakes and rivers. They require trees with woodpecker holes or other cavities for nesting in some proximity to water.
State Status – None

Black-capped Chickadee – *Parus atricapillus*
Black-capped Chickadees are commonly deciduous woodland birds, often found in riparian woodlands in eastern Oregon.
State Status – None

House Wren – *Troglodytes aedon*

In eastern Oregon, House Wrens are generally associated with brushy patches in open areas and frequently breed in aspen stands and riparian woodlands.
State Status – None

Swainson's Thrush – *Catharus ustulatus*
Swainson's Thrushes are found in higher elevation coniferous forests, primarily in riparian thickets in Ponderosa Pine forests.
State Status – None

MacGillivray's Warbler – *Oporornis tolmiei*
This species typically breeds in dense thickets, especially riparian willow and alder stands in or out of forests. It is also found along forest edges and in aspen stands.
State Status - None

Black-headed Grosbeak – *Pheucticus melanocephalus*
Black-headed Grosbeaks breed in deciduous woodlands that include a dense shrub understory. In eastern Oregon they are often found in riparian woodlands and thickets of aspen, cottonwood, willow, and/or alder.
State Status – None

Lazuli Bunting – *Passerina amoena*
Lazuli Buntings are found breeding in open habitats with a patchy shrub layer, including open juniper and riparian woodlands. In sagebrush areas of eastern Oregon, they are associated with riparian thickets.
State Status – None

Bullock's Oriole – *Icterus galbula bullockii*
This species nests primarily in deciduous woodlands. In eastern Oregon, Bullock's Orioles are often found in willow and cottonwood riparian woodlands, or in large trees near human habitation.
State Status – None

American Goldfinch – *Carduelis tristis*
American Goldfinches are found in open habitats scattered with thickets of shrubs or low trees, especially willow thickets in riparian areas. Like many species it is restricted to riparian areas and towns in arid regions of eastern Oregon.
State Status – None

Lesser Goldfinch – *Carduelis psaltria*
Like the American Goldfinch, the Lesser Goldfinch is found in more open areas with scattered trees or shrubs, including juniper woodlands, and is often found near water. Again, it is restricted to riparian areas in arid eastern Oregon.
State Status – None

Riparian Obligates^2:

Bald Eagle – Haliaeetus leucocephalus
The Bald Eagle is strongly associated with water surrounded by tall nesting trees, and is found along coasts, rivers, lakes and marshes. In eastern Oregon, a large population can be found in the Klamath area. The presence of Bald Eagles is likely related to adequate foraging opportunities (e.g. fish availability), and does not necessarily indicate anything about the condition of the riparian vegetation or the functionality of the system[7].
State Status – Threatened; Federal Status – Threatened

Yellow-billed Cuckoo – *Coccyzus americanus*
The habitat of the Yellow-billed Cuckoo includes an extensive stand of closed canopy riparian forest, with a dense understory. Historically in eastern Oregon, this species would have been found in willow and black cottonwood (*Populus trichocarpa*) along major rivers. Currently this species is limited to a couple of pairs in eastern Oregon, including sightings, but not confirmed breeding status, of an individual on the Blitzen River in Malheur National Wildlife Refuge (A. Holmes, personal communication). Declines in this species are attributed to loss of habitat which includes at least 37 acres of suitable breeding habitat. Yellow-billed Cuckoos would be an excellent indicator of riparian functionality and the condition of the riparian vegetation. However, because of the near loss of this species from Oregon, it is unlikely that any individuals will be found, even in any exceptional riparian habitat. This species has been identified as requiring conservation action in the Great Basin region.
State Status – Sensitive

Belted Kingfisher – *Ceryle alcyon*
Belted Kingfishers forage and nest on and near water. Nest burrows are primarily dug in natural embankments, e.g. streambanks. This species is associated with water, but not with any particular riparian habitat type. Therefore, the Belted Kingfisher is not a good indicator of the condition of the riparian vegetation.
State Status – None

Willow Flycatcher – *Empidonax traillii*
Willow Flycatcher's are known riparian habitat breeders, frequenting willow thickets and brushy vegetation along streams flowing through meadows and marshes. The species is described as a "locally common summer resident east of the Cascades" in Gilligan et al. (1994) and is shown by Csuti et al. (1997) to have a slightly patchy, but fairly extensive range in eastern Oregon. However, no personal observations were made of this species in the area of our study sites. Willow Flycatchers have been reported by three independent studies to respond negatively to livestock grazing (Saab et al. 1995). Willow Flycatchers are a good indicator of riparian functionality and riparian vegetation condition for this area. This species has been identified as requiring conservation action in the Great Basin region.
State Status – None; Federal Status – SC

American Dipper – *Cinclus mexicanus*

A strictly riparian species, the American Dipper forages in rapidly flowing rivers and streams, primarily in coniferous forests. As a riparian indicator species, this species requires clear water for foraging. Therefore, any human activities that cause an increase in the sediment load in streams may negatively affect this species. However, presence of the American Dipper does not necessarily indicate anything about the condition of the riparian vegetation.
State Status – None

Veery – *Catharus fuscescens*
The Veery is generally associated with moist woodlands and is limited to the riparian woodlands and thickets in north-eastern Oregon and to localized cottonwood riparian forests along the John Day River. The Veery is identified as a species requiring conservation action in the Great Basin Region.
State Status - None

American Redstart – *Setophaga ruticilla*
This species is also limited primarily to deciduous riparian thickets in the coniferous forests of north-eastern Oregon in the Blue and Wallowa Mountains. It is also found locally on the east slope of the southern Oregon Cascades.
State Status – None

Orange-crowned Warbler – *Vermivora celata*
The Orange-crowned Warbler has a patchy distribution east of the Cascades. It is found in dense forests with a thick understory, often breeding in the thickets and shrubs along streams and rivers. In eastern Oregon it is also found in dense stands of aspen, alder and willow. This species is identified as requiring conservation action in the Great Basin region.
State Status - None

Common Yellowthroat – *Geothlypis trichas*
Common Yellowthroats prefer wet, marshy areas, characterized by cattails, willows and other dense, lush grass and brushy vegetation. The species has a patchy distribution in eastern Oregon, and is restricted to riparian habitat in arid regions. It is a common host for Brown-headed Cowbird (*Molothrus ater*) nest parasitism and has been reported to respond negatively to livestock grazing (Saab et al. 1995). Common Yellowthroats are an excellent indicator of riparian functionality and riparian vegetation condition.
State Status – None

Wilson's Warbler - *Wilsonia pusilla*
In eastern Oregon, Wilson's Warblers are found in dense deciduous brush, including willow and alder thickets, associated with riparian areas in woodlands and forests. It has a patchy distribution in eastern Oregon, limited primarily to the east side of the Cascades, and the mountains of eastern Oregon. This species is also a host to cowbird parasitism and declines in populations have been attributed to high levels of parasitism. Wilson's Warblers were reported to respond negatively to heavy livestock grazing by Schultz and Leininger (1991) and positively to variable grazing intensity by Crouch (1982). This

species is an excellent indicator of riparian functionality and riparian vegetation condition in this area. Wilson's Warblers have been identified as requiring conservation action in the Great Basin region.
State Status – None

Yellow-breasted Chat – ***Icteria virens***
Yellow-breasted Chats breed in dense riparian brush and woodlands along rivers and streams. This species has a fairly extensive, but patchy, distribution in eastern Oregon. However, declines in populations have been noted and attributed to loss of riparian habitat through livestock grazing and riparian area development. Moderate levels of livestock grazing were reported to negatively affect Yellow-breasted Chats by Sedgwick and Knopf (1987). In contrast, Taylor (1986) reported no response to variable grazing intensity in Oregon. The Yellow-breasted Chat is an excellent indicator of riparian functionality and riparian vegetation condition in this region. This species has been identified as requiring conservation action in the Great Basin region.
State Status – None

Yellow Warbler – ***Dendroica petechia***
The Yellow Warbler breeds primarily in brushy riparian habitat including willow, cottonwood, alder and aspen groves. Yellow Warblers were reported to respond negatively to livestock grazing by Taylor (1986), and Mosconi and Hutto (1982). Knopf et al. (1988) reported no response, and Page et al. (1978) reported a positive response. Declines in Western populations have been attributed to livestock grazing (Taylor and Littlefield 1986) and to heavy nest parasitism by Brown-headed Cowbirds. Yellow Warblers are an excellent indicator of riparian functionality and riparian vegetation condition in this region.
State Status – None

Song Sparrow – ***Melospiza melodia***
Song Sparrows breed in thickets of deciduous vegetation and therefore are commonly restricted to riparian areas in eastern Oregon. This is another species that is commonly parasitized by Brown-headed Cowbirds. Although classified as a riparian obligate by PIF, Song Sparrows are, by their definition, a good indicator of "riparian vegetation in good ecological condition". However, Song Sparrows are more "relaxed" in their riparian vegetation requirements than the other riparian obligates listed, and appear to be less "sensitive" to riparian habitat conditions (personal observation). Therefore this species is not an excellent indicator of riparian condition, but does indicate the presence of some riparian vegetation in good condition.
State Status – None

Notes:

1. Eastern Oregon is loosely defined as the area of Oregon east of the Cascade Mountain Range.
2. Riparian species defined as riparian dependents or riparian obligates by the Bureau of Land Management (BLM) and Partners in Flight (PIF) in "Birds as

indicators of riparian vegetation condition in the western U.S." (BLM/ID/PIF/PT-98/004+6635). See text (pg. xx) for definitions.

3. Species written in bold type have the potential to be observed in habitats where study sites were located, e.g. riparian habitat within shrub-steppe habitat. Species not written in bold type are not likely to be found on any of the study sites because of their general habitat associations, e.g. riparian habitat within dense coniferous forest, or because of the limits of their geographic occurrence, e.g. restricted to the Blue Mountains of north-eastern Oregon.
4. Geographic occurrence and general habitat association information for all species was compiled from Csuti et al. (1997), Ehrlich et al. (1988), Gilligan et al. (1994) and the Lanius InFlight Database (1998).
5. Riparian species that require conservation action in the Great Basin region was determined by the Western Working Group of Partner's In Flight (BLM/ID/PIF/PT-98/004+6635).
6. State and Federal status as listed in Csuti et al. (1997). Federal status indicated only when it is other than "no status".
7. The usefulness of a species in indicating riparian functionality or the condition of the riparian vegetation is noted only for the obligate riparian species likely to be observed on the study sites. Dependent riparian species although associated with riparian habitat, can still be found in areas where the riparian system is not in a functioning condition, or where the riparian vegetation is highly degraded (BLM/PIF). Therefore, they should not be used as functioning riparian system indicators.

Appendix 3. Woody Vegetation Species and Groups Observed at Study Sites in 2000.

Riparian associated species	
Peach-leaf Willow	*Salix amygdaloides*
Coyote Willow	*Salix exigua*
Pacific or red Willow	*Salix lasiandra*
Arroyo Willow	*Salix lasiolepis*
Lemmon's Willow	*Salix lemmonii*
Mackenzie Willow or Watson Willow	*Salix rigida* var *mackenzieana* or *Salix rigida* var *watsonii*
Salix species	*Salix sp.*
Black Cottonwood	*Populus trichocarpa*
Lombardy Poplar	*Populus nigr* var *italica*
White Alder	*Alnus rhombifolia*
Red Alder	*Alnus rubra*
Red Birch	*Betula occidentalis*
Red-osier dogwood	*Cornus stolonifera*
Common Chokecherry	*Prunus virginiana*
Blue elderberry	*Sambucus cerulea*
Mountain Snowberry	*Symphoricarpos oreophilus*
Gooseberry/Currant	*Ribes sp.*
Wild Rose	*Rosa woodsii*
Blackberry species	*Rubus sp.*
Western Clematis	*Clematis ligusticifolia*
Syringa	*Philadelphus lewisii*
Russian Olive	*Elaeagnus augustifolia*

Upland associated species	
Tall Sagebrush	*Artemesia tridentata*
Gray Rabbit-brush	*Chrysothamnus nauseosus*
Green Rabbit-brush	*Chrysothamnus viscidiflorus*
Antelope Bitterbrush	*Purshia tridentata*
Ephedra species	*Ephedra sp.*
Western Juniper	*Juniperus occidentalis*
Ponderosa Pine	*Pinus ponderosa*
Douglas Fir	*Pseudostuga menziesii*
Black Locust	*Robinia pseudoacacia*
Catalpa	*Catalpa sp.*

Appendix 4. Summary of species observed at thirteen study sites in 1999. See appendix 6 for site code names.

Common Name	Scientific Name	BRNO	BRSO	BRWE	BREA
Mallard	*Anas platyrhynchos*		x	x	x
Cinnamon Teal	*Anas cyanoptera*		x		
Redhead	*Aythya americana*				
Common Merganser	*Mergus merganser*		x		x
Turkey Vulture	*Cathartes aura*				
Golden Eagle	*Aquila chrysaetos*			x	x
Red-tailed Hawk	*Buteo jamaicensis*	x	x		x
American Kestrel	*Falco sparverius*	x	x	x	
California Quail	*Callipepla californica*	x	x	x	x
Killdeer	*Charadrius vociferus*	x		x	
Spotted Sandpiper	*Actitis macularia*	x	x	x	x
Mourning Dove	*Zenaida macroura*	x	x	x	x
Rock Dove	*Columba livia*			x	
Western Screech Owl	*Otus kennicottii*				
Common Nighthawk	*Chordeiles minor*		x		
White-throated Swift	*Aeronautes saxatalis*	x			
Belted Kingfisher	*Ceryle alcyon*				x
Northern Flicker	*Colaptes auratus*	x	x	x	x
Western Wood-pewee	*Contopus sordidulus*	x	x	x	x
Gray Flycatcher	*Empidonax wrightii*				
Ash-throated Flycatcher	*Myiarchus cinerascens*	x	x	x	
Say's Phoebe	*Sayornis saya*	x	x	x	x
Eastern Kingbird	*Tyrannus tyrannus*	x			
Western Kingbird	*Tyrannus verticalis*	x	x	x	x
Loggerhead Shrike	*Lanius ludovicianus*		x		
Warbling Vireo	*Vireo gilvus*	x			
Stellar's Jay	*Cyanocitta stelleri*				
Black-billed Magpie	*Pica pica*		x	x	x
Common Raven	*Corvus corax*	x	x	x	x
Bank Swallow	*Riparia riparia*	x	x	x	x
Tree Swallow	*Tachycineta bicolor*		x	x	
Barn Swallow	*Hirundo rustica*				x
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x	x	x	x
Violet-green Swallow	*Tachycineta thalassina*	x			
Cliff Swallow	*Petrochelidon pyrrhonota*	x		x	x
Black-capped Chickadee	*Poecile atricapillus*				
Mountain Chickadee	*Poecile gambeli*				
Bushtit	*Psaltriparus minimus*				
House Wren	*Troglodytes aedon*			x	
Canyon Wren	*Catherpes mexicanus*	x			
Rock Wren	*Salpinctes obsoletus*	x	x		x
Mountain Bluebird	*Sialia mexicana*			x	

Common Name	Scientific Name	BRNO	BRSO	BRWE	BREA
American Robin	*Turdus migratorius*	x	x	x	x
Sage Thrasher	*Oreoscoptes montanus*				
European Starling	*Sturnus vulgaris*	x	x	x	x
Cedar Waxwing	*Bombycilla cedrorum*	x		x	
Common Yellowthroat	*Geothylpis trichas*				x
Wilson's Warbler	*Wilsonia pusilla*	x			
Yellow-breasted Chat	*Icteria virens*				x
Yellow Warbler	*Dendroica petechia*	x	x	x	x
Black-throated Grey Warbler	*Dendroica nigrescens*		x		
Audubon's Warbler	*Dendroica coronata*			x	
Western Tanager	*Piranga ludoviciana*	x		x	x
Spotted Towhee	*Pipilo maculatus*	x	x	x	x
Vesper Sparrow	*Poocetes gramineus*				
Lark Sparrow	*Chondestes grammacus*	x	x		
Brewer's Sparrow	*Spizella breweri*				
Chipping Sparrow	*Spizella passerina*	x	x	x	x
Song Sparrow	*Melospiza melodia*	x	x	x	x
Black-headed Grosbeak	*Pheucticus melanocephalus*	x		x	x
Lazuli Bunting	*Passerina amoena*	x	x	x	x
Western Meadowlark	*Sturnella neglecta*	x	x	x	x
Red-winged Blackbird	*Agelaius phoeniceus*	x	x	x	x
Brewer's Blackbird	*Euphagus cyanocephalus*	x	x	x	x
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			x	
Brown-headed Cowbird	*Molothrus ater*	x	x	x	x
Bullock's Oriole	*Icterus bullockii*	x	x	x	x
House Finch	*Carpodarcus mexicanus*		x	x	x
American Goldfinch	*Carduelis tristis*	x	x	x	x
House Sparrow	*Passer domesticus*			x	

Common Name	Scientific Name	MUCR	MECA	NECR	CASO
Mallard	*Anas platyrhynchos*	x			
Cinnamon Teal	*Anas cyanoptera*				
Redhead	*Aythya americana*				x
Common Merganser	*Mergus merganser*				
Turkey Vulture	*Cathartes aura*				
Golden Eagle	*Aquila chrysaetos*				
Red-tailed Hawk	*Buteo jamaicensis*	x	x		x
American Kestrel	*Falco sparverius*	x	x		x
California Quail	*Callipepla californica*	x	x	x	
Killdeer	*Charadrius vociferus*				x
Spotted Sandpiper	*Actitis macularia*			x	
Mourning Dove	*Zenaida macroura*	x	x	x	x
Rock Dove	*Columba livia*				
Western Screech Owl	*Otus kennicottii*				x
Common Nighthawk	*Chordeiles minor*	x			
White-throated Swift	*Aeronautes saxatalis*	x			
Belted Kingfisher	*Ceryle alcyon*			x	

Common Name	**Scientific Name**	**MUCR**	**MECA**	**NECR**	**CASO**
Northern Flicker	*Colaptes auratus*	x	x	x	x
Western Wood-pewee	*Contopus sordidulus*	x	x	x	
Gray Flycatcher	*Empidonax wrightii*	x	x		
Ash-throated Flycatcher	*Myiarchus cinerascens*	x	x	x	x
Say's Phoebe	*Sayornis saya*	x	x	x	x
Eastern Kingbird	*Tyrannus tyrannus*				
Western Kingbird	*Tyrannus verticalis*	x	x	x	
Loggerhead Shrike	*Lanius ludovicianus*				
Warbling Vireo	*Vireo gilvus*				
Stellar's Jay	*Cyanocitta stelleri*			x	
Black-billed Magpie	*Pica pica*	x	x	x	x
Common Raven	*Corvus corax*	x	x	x	x
Bank Swallow	*Riparia riparia*	x		x	
Tree Swallow	*Tachycineta bicolor*				
Barn Swallow	*Hirundo rustica*	x			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x	x	x	x
Violet-green Swallow	*Tachycineta thalassina*	x	x		
Cliff Swallow	*Petrochelidon pyrrhonota*	x			
Black-capped Chickadee	*Poecile atricapillus*				
Mountain Chickadee	*Poecile gambeli*				
Bushtit	*Psaltriparus minimus*	x		x	
House Wren	*Troglodytes aedon*				
Canyon Wren	*Catherpes mexicanus*	x			
Rock Wren	*Salpinctes obsoletus*		x		
Mountain Bluebird	*Sialia mexicana*				x
American Robin	*Turdus migratorius*	x	x	x	x
Sage Thrasher	*Oreoscoptes montanus*				x
European Starling	*Sturnus vulgaris*	x			
Cedar Waxwing	*Bombycilla cedrorum*			x	
Common Yellowthroat	*Geothylpis trichas*				
Wilson's Warbler	*Wilsonia pusilla*	x		x	
Yellow-breasted Chat	*Icteria virens*				
Yellow Warbler	*Dendroica petechia*			x	
Black-throated Grey Warbler	*Dendroica nigrescens*	x	x	x	
Audubon's Warbler	*Dendroica coronata*				
Western Tanager	*Piranga ludoviciana*	x		x	
Spotted Towhee	*Pipilo maculatus*	x		x	x
Vesper Sparrow	*Poocetes gramineus*				x
Lark Sparrow	*Chondestes grammacus*				
Brewer's Sparrow	*Spizella breweri*				x
Chipping Sparrow	*Spizella passerina*	x	x	x	
Song Sparrow	*Melospiza melodia*	x	x	x	
Black-headed Grosbeak	*Pheucticus melanocephalus*	x			
Lazuli Bunting	*Passerina amoena*	x	x	x	
Western Meadowlark	*Sturnella neglecta*	x	x	x	x
Red-winged Blackbird	*Agelaius phoeniceus*	x	x		x

Common Name	Scientific Name	MUCR	MECA	NECR	CASO
Brewer's Blackbird	*Euphagus cyanocephalus*	x	x	x	x
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*				
Brown-headed Cowbird	*Molothrus ater*	x	x	x	x
Bullock's Oriole	*Icterus bullockii*	x	x	x	
House Finch	*Carpodarcus mexicanus*	x	x	x	x
American Goldfinch	*Carduelis tristis*	x	x	x	
House Sparrow	*Passer domesticus*				

Common Name	Scientific Name	CANO	BENO	BESO	BEAS	BEA
Mallard	*Anas platyrhynchos*	x	x	x		
Cinnamon Teal	*Anas cyanoptera*					
Redhead	*Aythya americana*					
Common Merganser	*Mergus merganser*					
Turkey Vulture	*Cathartes aura*				x	
Golden Eagle	*Aquila chrysaetos*	x				
Red-tailed Hawk	*Buteo jamaicensis*		x		x	x
American Kestrel	*Falco sparverius*	x	x	x		
California Quail	*Callipepla californica*	x		x	x	x
Killdeer	*Charadrius vociferus*	x				
Spotted Sandpiper	*Actitis macularia*					
Mourning Dove	*Zenaida macroura*	x	x	x	x	x
Rock Dove	*Columba livia*		x			
Western Screech Owl	*Otus kennicottii*	x				
Common Nighthawk	*Chordeiles minor*					
White-throated Swift	*Aeronautes saxatalis*					
Belted Kingfisher	*Ceryle alcyon*	x		x		
Northern Flicker	*Colaptes auratus*	x	x	x	x	x
Western Wood-pewee	*Contopus sordidulus*					
Gray Flycatcher	*Empidonax wrightii*		x	x	x	x
Ash-throated Flycatcher	*Myiarchus cinerascens*		x	x	x	x
Say's Phoebe	*Sayornis saya*					
Eastern Kingbird	*Tyrannus tyrannus*					
Western Kingbird	*Tyrannus verticalis*		x		x	x
Loggerhead Shrike	*Lanius ludovicianus*					
Warbling Vireo	*Vireo gilvus*					
Stellar's Jay	*Cyanocitta stelleri*					
Black-billed Magpie	*Pica pica*		x	x		
Common Raven	*Corvus corax*	x	x	x		x
Bank Swallow	*Riparia riparia*	x	x			x
Tree Swallow	*Tachycineta bicolor*					
Barn Swallow	*Hirundo rustica*	x		x		x
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x	x	x	x	x
Violet-green Swallow	*Tachycineta thalassina*		x			
Cliff Swallow	*Petrochelidon pyrrhonota*	x	x	x	x	x
Black-capped Chickadee	*Poecile atricapillus*		x	x		
Mountain Chickadee	*Poecile gambeli*			x		

Common Name	Scientific Name	CANO	BENO	BESO	BEAS	BEAN
Bushtit	*Psaltriparus minimus*			x		
House Wren	*Troglodytes aedon*		x	x	x	x
Canyon Wren	*Catherpes mexicanus*		x			
Rock Wren	*Salpinctes obsoletus*		x	x	x	x
Mountain Bluebird	*Sialia mexicana*	x			x	
American Robin	*Turdus migratorius*	x	x	x	x	x
Sage Thrasher	*Oreoscoptes montanus*	x				
European Starling	*Sturnus vulgaris*			x		x
Cedar Waxwing	*Bombycilla cedrorum*				x	
Common Yellowthroat	*Geothylpis trichas*					
Wilson's Warbler	*Wilsonia pusilla*			x		
Yellow-breasted Chat	*Icteria virens*					
Yellow Warbler	*Dendroica petechia*					
Black-throated Grey Warbler	*Dendroica nigrescens*		x			
Audubon's Warbler	*Dendroica coronata*					
Western Tanager	*Piranga ludoviciana*			x		
Spotted Towhee	*Pipilo maculatus*				x	
Vesper Sparrow	*Poocetes gramineus*	x		x		x
Lark Sparrow	*Chondestes grammacus*					
Brewer's Sparrow	*Spizella breweri*	x	x	x	x	x
Chipping Sparrow	*Spizella passerina*		x	x	x	x
Song Sparrow	*Melospiza melodia*		x	x	x	x
Black-headed Grosbeak	*Pheucticus melanocephalus*					
Lazuli Bunting	*Passerina amoena*			x		x
Western Meadowlark	*Sturnella neglecta*	x		x	x	x
Red-winged Blackbird	*Agelaius phoeniceus*	x	x	x	x	x
Brewer's Blackbird	*Euphagus cyanocephalus*	x	x	x	x	x
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*					
Brown-headed Cowbird	*Molothrus ater*	x	x	x	x	x
Bullock's Oriole	*Icterus bullockii*		x	x	x	x
House Finch	*Carpodarcus mexicanus*		x		x	x
American Goldfinch	*Carduelis tristis*				x	
House Sparrow	*Passer domesticus*					

Appendix 5. Summary of species observed at ten study sites in 2000. See appendix 6 for study site codes.

Common Name	***Scientific Name***	**BEAR**	**BREA**	**BRNO**	**BRSO**	**DUBS**
Canada Goose	*Branta canadensis*					
Common Merganser	*Mergus merganser*			x		x
Turkey Vulture	*Cathartes aura*		x			x
Bald Eagle	*Haliaeetus leucocepphalus*					
Cooper's Hawk	*Accipiter cooperii*			x		
Red-tailed Hawk	*Buteo jamaicensis*	x	x	x	x	
American Kestrel	*Falco sparverius*	x		x		
Chukar	*Alectoris chukar*					
Ring-necked Pheasant	*Phasianus colchicus*			x		
Mountain Quail	*Oreortyx pictus*			x		
California Quail	*Callipepla californica*	x	x	x		
Killdeer	*Charadrius vociferus*	x		x		
Spotted Sandpiper	*Actitis macularia*	x	x	x	x	x
Mourning Dove	*Zenaida macroura*	x	x	x	x	x
Rock Dove	*Columba livia*					
Western Screech Owl	*Otus kennicottii*					
Common Nighthawk	*Chordeiles minor*					
Vaux's Swift	*Chaetura vauxi*					
Unidentified Swift			x	x	x	
Rufous Hummingbird	*Selasphorus rufus*			x		
Belted Kingfisher	*Ceryle alcyon*	x	x	x		
Northern Flicker	*Colaptes auratus*	x	x	x	x	x
Lewis' Woodpecker	*Melanerpes lewis*					
Downy Woodpecker	*Picoides pubescens*		x			
Olive-sided Flycatcher	*Contopus cooperi*		x		x	
Western Wood-pewee	*Contopus sordidulus*	x	x	x	x	x
Ash-throated Flycatcher	*Myiarchus cinerascens*	x	x	x	x	
Say's Phoebe	*Sayornis saya*		x	x		
Eastern Kingbird	*Tyrannus tyrannus*			x		
Western Kingbird	*Tyrannus verticalis*	x	x	x	x	x
Loggerhead Shrike	*Lanius ludovicianus*				x	
Warbling Vireo	*Vireo gilvus*					
Red-eyed Vireo	*Vireo olivaceus*					
Stellar's Jay	*Cyanocitta stelleri*					
Black-billed Magpie	*Pica pica*		x		x	x
Common Raven	*Corvus corax*	x	x		x	x
Bank Swallow	*Riparia riparia*		x	x	x	
Barn Swallow	*Hirundo rustica*		x		x	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		x	x	x	x
Violet-green Swallow	*Tachycineta thalassina*	x	x	x	x	x
Cliff Swallow	*Petrochelidon pyrrhonota*		x	x		x
Mountain Chickadee	*Poecile gambeli*					

Common Name	***Scientific Name***	**BEAR**	**BREA**	**BRNO**	**BRSO**	**DUBS**
Bushtit	*Psaltriparus minimus*				x	
Red-breasted Nuthatch	*Sitta canadensis*					
House Wren	*Troglodytes aedon*	x				
Canyon Wren	*Catherpes mexicanus*			x	x	x
Rock Wren	*Salpinctes obsoletus*	x	x	x	x	x
American Dipper	*Cinclus mexicanus*					
Mountain Bluebird	*Sialia mexicana*					x
American Robin	*Turdus migratorius*	x	x	x	x	x
European Starling	*Sturnus vulgaris*	x	x	x	x	
Cedar Waxwing	*Bombycilla cedrorum*		x	x	x	
Common Yellowthroat	*Geothylpis trichas*					x
Wilson's Warbler	*Wilsonia pusilla*		x		x	x
Yellow-breasted Chat	*Icteria virens*		x	x		x
Yellow Warbler	*Dendroica petechia*		x	x	x	x
Black-throated Grey Warbler	*Dendroica nigrescens*	x	x		x	x
Western Tanager	*Piranga ludoviciana*		x			
Spotted Towhee	*Pipilo maculatus*	x	x	x	x	x
Lark Sparrow	*Chondestes grammacus*	x		x		
Chipping Sparrow	*Spizella passerina*	x	x	x	x	
Song Sparrow	*Melospiza melodia*	x	x	x	x	x
White-crowned Sparrow	*Zonotrichia atricapilla*				x	
Oregon Junco	*Junco hyemalis thurberi*					
Black-headed Grosbeak	*Pheucticus melanocephalus*		x	x	x	x
Lazuli Bunting	*Passerina amoena*	x	x	x	x	x
Western Meadowlark	*Sturnella neglecta*	x	x	x	x	x
Red-winged Blackbird	*Agelaius phoeniceus*	x	x	x	x	x
Brewer's Blackbird	*Euphagus cyanocephalus*	x	x	x	x	x
Brown-headed Cowbird	*Molothrus ater*	x	x	x	x	x
Bullock's Oriole	*Icterus bullockii*	x	x	x	x	x
House Finch	*Carpodarcus mexicanus*	x	x	x	x	x
American Goldfinch	*Carduelis tristis*	x	x	x	x	x
Lesser Goldfinch	*Carduelis psaltria*		x			x

Common Name	***Scientific Name***	**SJDA**	**SJDB**	**SJDC**	**SJDD**	**TEMI**
Canada Goose	*Branta canadensis*		x			
Common Merganser	*Mergus merganser*	x	x			
Turkey Vulture	*Cathartes aura*		x			x
Bald Eagle	*Haliaeetus leucocephalus*		x			
Cooper's Hawk	*Accipiter cooperii*					
Red-tailed Hawk	*Buteo jamaicensis*					x
American Kestrel	*Falco sparverius*		x	x	x	x
Chukar	*Alectoris chukar*			x		
Ring-necked Pheasant	*Phasianus colchicus*					
Mountain Quail	*Oreortyx pictus*					
California Quail	*Callipepla californica*	x	x		x	x
Killdeer	*Charadrius vociferus*	x				

Common Name	***Scientific Name***	**SJDA**	**SJDB**	**SJDC**	**SJDD**	**TEMI**
Spotted Sandpiper	*Actitis macularia*	x	x		x	x
Mourning Dove	*Zenaida macroura*	x	x	x	x	x
Rock Dove	*Columba livia*					x
Western Screech Owl	*Otus kennicottii*				x	
Common Nighthawk	*Chordeiles minor*	x			x	
Vaux's Swift	*Chaetura vauxi*		x			
Unidentified Swift						x
Rufous Hummingbird	*Selasphorus rufus*					
Belted Kingfisher	*Ceryle alcyon*		x		x	x
Northern Flicker	*Colaptes auratus*	x	x	x	x	x
Lewis' Woodpecker	*Melanerpes lewis*		x	x		
Downy Woodpecker	*Picoides pubescens*				x	
Olive-sided Flycatcher	*Contopus cooperi*					
Western Wood-pewee	*Contopus sordidulus*	x	x		x	x
Ash-throated Flycatcher	*Myiarchus cinerascens*					x
Say's Phoebe	*Sayornis saya*					x
Eastern Kingbird	*Tyrannus tyrannus*					
Western Kingbird	*Tyrannus verticalis*				x	x
Loggerhead Shrike	*Lanius ludovicianus*					
Warbling Vireo	*Vireo gilvus*	x			x	
Red-eyed Vireo	*Vireo olivaceus*					x
Stellar's Jay	*Cyanocitta stelleri*	x	x	x	x	x
Black-billed Magpie	*Pica pica*	x	x	x	x	x
Common Raven	*Corvus corax*	x			x	x
Bank Swallow	*Riparia riparia*					x
Barn Swallow	*Hirundo rustica*					
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x	x		x	x
Violet-green Swallow	*Tachycineta thalassina*		x	x	x	x
Cliff Swallow	*Petrochelidon pyrrhonota*	x	x			x
Mountain Chickadee	*Poecile gambeli*	x		x	x	x
Bushtit	*Psaltriparus minimus*	x			x	x
Red-breasted Nuthatch	*Sitta canadensis*				x	
House Wren	*Troglodytes aedon*		x			
Canyon Wren	*Catherpes mexicanus*		x	x	x	x
Rock Wren	*Salpinctes obsoletus*		x		x	x
American Dipper	*Cinclus mexicanus*		x			
Mountain Bluebird	*Sialia mexicana*					
American Robin	*Turdus migratorius*	x	x	x	x	x
European Starling	*Sturnus vulgaris*				x	
Cedar Waxwing	*Bombycilla cedrorum*	x			x	
Common Yellowthroat	*Geothylpis trichas*					
Wilson's Warbler	*Wilsonia pusilla*					
Yellow-breasted Chat	*Icteria virens*	x	x		x	x
Yellow Warbler	*Dendroica petechia*	x	x	x	x	
Black-throated Grey Warbler	*Dendroica nigrescens*	x			x	x
Western Tanager	*Piranga ludoviciana*		x	x	x	

Common Name	***Scientific Name***	**SJDA**	**SJDB**	**SJDC**	**SJDD**	**TEMI**
Spotted Towhee	*Pipilo maculatus*	x	x	x	x	x
Lark Sparrow	*Chondestes grammacus*					
Chipping Sparrow	*Spizella passerina*		x	x		x
Song Sparrow	*Melospiza melodia*	x	x	x	x	x
White-crowned Sparrow	*Zonotrichia atricapilla*					
Oregon Junco	*Junco hyemalis thurberi*			x	x	
Black-headed Grosbeak	*Pheucticus melanocephalus*	x	x		x	
Lazuli Bunting	*Passerina amoena*	x	x	x	x	x
Western Meadowlark	*Sturnella neglecta*	x	x	x	x	x
Red-winged Blackbird	*Agelaius phoeniceus*				x	x
Brewer's Blackbird	*Euphagus cyanocephalus*				x	x
Brown-headed Cowbird	*Molothrus ater*	x	x	x	x	x
Bullock's Oriole	*Icterus bullockii*	x	x	x	x	x
House Finch	*Carpodarcus mexicanus*	x				x
American Goldfinch	*Carduelis tristis*	x	x	x		x
Lesser Goldfinch	*Carduelis psaltria*					

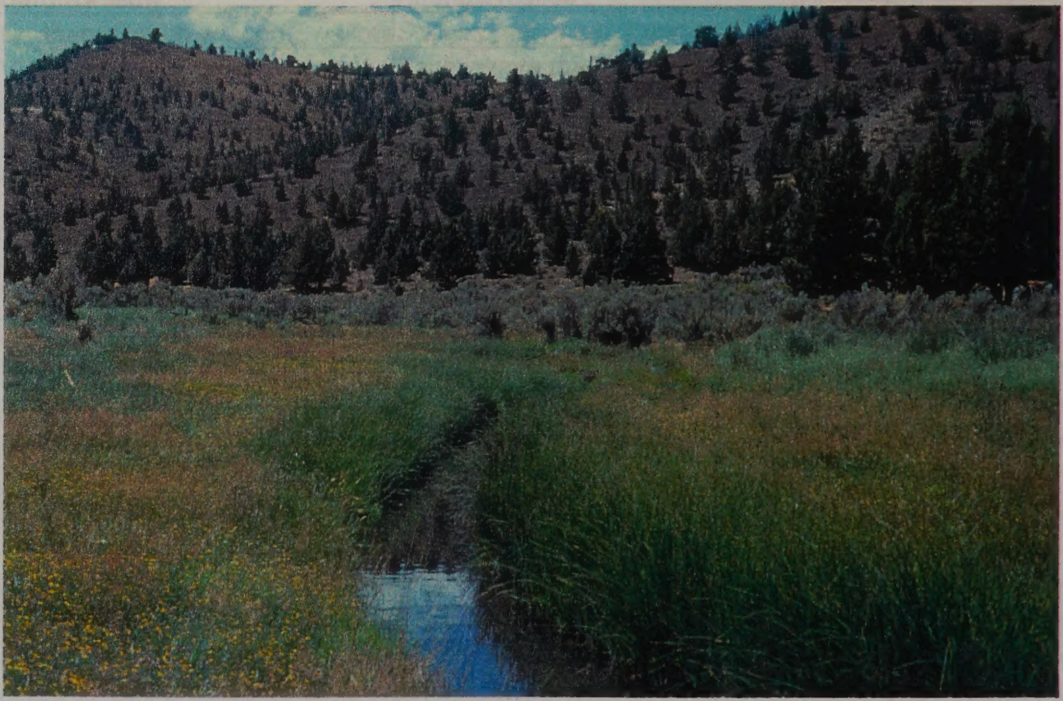
Appendix 6. Study sites as habitat for riparian associated bird species. The year of research activity on a given study site is indicated in parenthesis. See the annotated riparian avian species list in Appendix 2 for general habitat descriptions, conservation status, and use of the species as riparian habitat indicators.

BENO – Bear Creek Section 1 (1999)

This study site was located on property owned by Rance and Nancy Kastor along Bear Creek in Crook County, immediately upstream of the Prineville Reservoir. The upstream perimeter of the study site was located at the boundary with BLM managed land. See study site locator map (Appendix 7; Map 1).

Riparian habitat on this study site was wet meadow, and the condition and extent of the herbaceous riparian vegetation varied along the length of the study site (see Photo 1). Very little woody riparian vegetation existed along this riparian corridor. This section of Bear Creek was grazed by livestock during the spring and summer of 1999. No bird species were observed that indicate riparian functionality or good riparian vegetation condition. A single riparian bird species that was observed during a survey, a Song Sparrow, was actually observed on BLM property immediately adjacent to the perimeter of the study site. Potential of this habitat to support riparian species requiring any woody vegetation is low. Adjacent junipers could provide a component of appropriate habitat for House Wrens and Bullock's Orioles, two species that were observed on single occasions on the study site.

Photo 1. BENO, sample point #6, upstream view.



BESO – Bear Creek Section 2 (1999)

This study site was located on BLM managed land along Bear Creek in Crook County, upstream of study site BENO. The leasee for this land was Richard Nelsen. See study site locator map (Appendix 7; Map 1).

Riparian habitat along this study site consisted primarily of wet meadow habitat, including sections of thick, tall, herbaceous vegetation such as cattails (see Photo 2). Only scattered riparian woody vegetation was present. Upland habitat consisted of sections of sagebrush flats and sagebrush shrub-steppe, and small patches of junipers. Probable riparian breeders include House Wrens and Song Sparrows. The lack of riparian indicator species requiring thicker patches of woody vegetation, such as Yellow Warblers, may be more indicative of the current potential of the area to be wet meadow habitat, rather than being indicative of a degraded riparian system. As a functioning riparian habitat, the scattered patches of woody vegetation provide appropriate habitat for Song Sparrows and Lazuli Buntings. And, the juniper tree component may assist in providing appropriate habitat for Western Wood-pewees, House Wrens, and Bullock's Orioles.

Photo 2. BESO, sample point # 8, upstream view.

BEAN – Bear Creek Section 3 (1999)
This study site is on property owned by Jim and Pam Hart along Bear Creek in Crook County, upstream of BESO. See study site locator map (Appendix 7; Map 1).

Riparian habitat along this section of Bear Creek consisted primarily of wet meadow, with scattered riparian woody vegetation and junipers. Upland habitat was sagebrush shrub-steppe and juniper woodlands. No vegetation assessment was conducted on this study site. No exceptional riparian habitat indicator species were observed. However, the observed species composition indicates the presence of some elements of riparian habitat, including scattered riparian shrub vegetation used primarily by the Song Sparrows and Lazuli Buntings, and the tree component that is important to House Wrens and Bullock's Orioles. None of these species were observed on two or more point count surveys so are not considered probable breeders. No photos are available for this study site.

BEAS – Bear Creek Section 4 (1999)
This study site is on BLM managed land along Bear Creek in Crook County, upstream of BEAN. The leasees for this land are Owin and Joann Dunkin. See study site locator map (Appendix 7; Map 1).

This final study site on the upstream section of Bear Creek had wet meadow riparian habitat and an overall greater cover of trees than the downstream sections. No vegetation assessment was conducted on this study site. No strong riparian functionality and habitat indicator species were observed. House Wrens were observed as probable breeders in this area. Other riparian species observed included Song Sparrows, Bullock's Orioles, and American Goldfinches. Like the other sections along this Bear Creek, the lack of riparian indicator species associated with complex woody vegetation may be more indicative of the current natural potential of the area to be wet meadow habitat, rather than being indicative of a degraded riparian system. No photos are available for this study site.

BEAR – Bear Creek (2000)
This study site is located on BLM managed land along Bear Creek, in the Bridge Creek Watershed in Wheeler County. The study site is on a section of Bear Creek that can be reached through the John Day Fossil Beds National Monument Painted Hills Unit. See study site locator map (Appendix 7; Map 1).

Riparian habitat varied along the length of the study site: ranging from a small amount of riparian woody vegetation cover at the upstream end to bare gravel beds and areas devoid of any herbaceous or woody riparian vegetation at the downstream end. This study site had the lowest average riparian shrub and tree cover (6.25% and 1.75% respectively), and the smallest average riparian shrub height and width (~7 meters and 1.5 meters respectively) of all study sites in 2000. Livestock grazing was observed on this section of Bear Creek in June, 2000. Riparian species observed on this study site included Western Wood-pewees, House Wrens, Song Sparrows, Lazuli Buntings, Bullock's Orioles, and American Goldfinches. Western Wood-pewees and American Goldfinches were probable breeders. No bird species were observed that indicate riparian functionality or good riparian vegetation condition. With restoration of woody vegetation complexity, this site has the potential to support some riparian indicator species, such as Yellow Warblers. However, to support any riparian indicator species, the average width of the woody vegetation must increase substantially past the measured seven meters, and the average shrub height must be greater than 1.5 meters. No photos are available for this study site.

BRWE – Bridge Creek "West" (1999)
This study site is located on property owned by Jack and Buzzy Habecker, and Judy Anderson in Wheeler County. It is on Bridge Creek, along Hwy 26 and Gage Rd. west of Burnt Ranch Rd. and east of West Branch Rd. The perimeters of the study site are bounded by the Habecker and Anderson properties. See study site locator map (Appendix 7; Map 1).

This small study site included land under different ownership and land use. Except for a couple of small sections of woody riparian habitat, most of the riparian corridor was very narrow and was tightly bordered by horse pasture and agricultural fields. No vegetation sampling was conducted at this study site. Several riparian birds were observed during surveys on this site, but none were observed on more than one occasion. No photos are available for this study site.

BREA – Bridge Creek "East" (1999 and 2000)

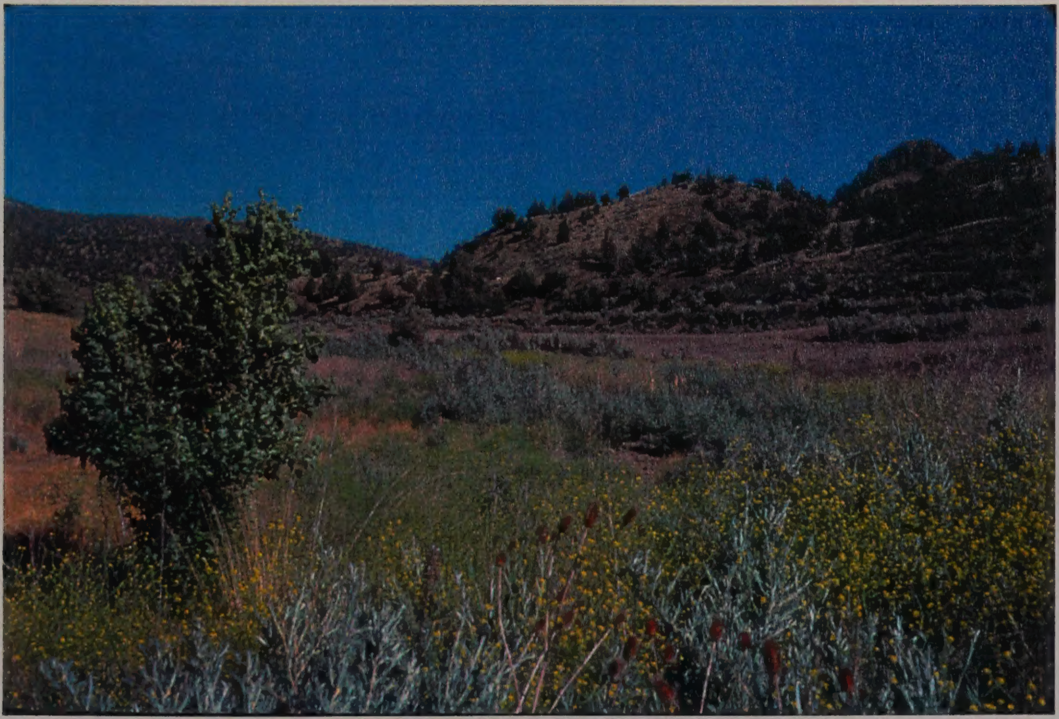
This study site is on BLM managed land on Bridge Creek in Wheeler County, along Highway 26 between the town of Mitchell and Burnt Ranch Rd., where Bridge Creek is on the north side of the highway. See study site locator map (Appendix 7; Map 1).

The riparian habitat along this section of Bridge Creek varies greatly from the upstream to downstream end. Closer to the upstream end of the study site, the riparian zone is extensive, measuring up to 100 meters across at one point, and including a diversity of riparian woody vegetation, and patches of thick, herbaceous riparian vegetation in standing water (see Photo 3). Towards the downstream end of the study site, the riparian system is in a more degraded condition, with less woody and herbaceous vegetation cover, and a lower diversity of woody riparian plant species (see Photo 4). This study site had an average woody riparian zone width of 20 meters, and an average riparian shrub height of 2.3 meters. *Salix* species were the dominant woody cover.

Over the two years, four riparian indicator bird species were observed: Common Yellowthroats, Wilson's Warblers, Yellow-breasted Chats, and Yellow Warblers. The later two being probable breeders on the study site. Also, it should be noted that in both years Yellow Warblers were observed at seven of the twelve points on the study site at the upstream end. The presence of the riparian indicator species indicates good condition of the riparian vegetation, and overall functionality of the system. Ten other riparian species were observed including five other probable breeders (see tables 1 to 4). The ability of this section of Bridge Creek to support a diversity of riparian species indicates a complex and extensive riparian habitat with a diversity of vegetative features, such as a thick understory and a tall tree component. Areas with this potential as habitat for riparian bird species should be targeted in management activities. Management goals should include restoring riparian habitat to the condition found at the upstream end along the entire length of this study site on Bridge Creek.

Photo 3. BREA, downstream view towards sample point #3.

Photo 4. BREA, sample point #11, upstream view.



BRNO – Bridge Creek "North" (1999 and 2000)
This study site is located on BLM managed land on Bridge Creek in Wheeler County, along Burnt Ranch Rd (off Hwy 26, west of Mitchell). The upstream perimeter of the study site is located at the boundary between the private property lying north of Bear Creek Rd (entrance to Painted Hills Unit) and BLM managed land. The downstream perimeter is located approximately 4.2 km. downstream at the end of the BLM managed land. See study site locater map (Appendix 7; Map 2).

Riparian habitat on this study site varied greatly along the length of the riparian corridor. Small, isolated patches of willow, primarily *Salix exigua*, were interspersed with broad areas of degraded riparian habitat, characterized by inadequate vegetation cover and unstable streambanks (see Photos 5 – 7). Upland habitat also varied greatly and included sagebrush flats, agricultural fields of wildlife cover crops and fields of weedy herbaceous vegetation such as cheatgrass (*Bromus tectorum*). In 2000, this study site had the second smallest average width (12.5 meters), very low average cover of riparian shrubs (~16%), and a low diversity of riparian woody species (~4 species).

Despite the overall lack of suitable songbird riparian habitat, patches did exist in which three riparian indicator species were observed over the two years. Yellow Warblers were not observed at all in 1999, but were observed on four of the 19 points in 2000, with only one point being a probable breeder observation. Yellow-breasted Chats were observed at the same two points in 1999 and 2000. And, a single Wilson's Warbler was observed at one point in 1999. Potential exists in areas of this study site to support a greater and more diverse number of riparian species. A more diverse and dense understory component, and an overall wider woody riparian zone that covers more of the length of the study site, is needed for this area to provide habitat for more riparian species.

Photo 5. BRNO, sample point #10, upstream view.

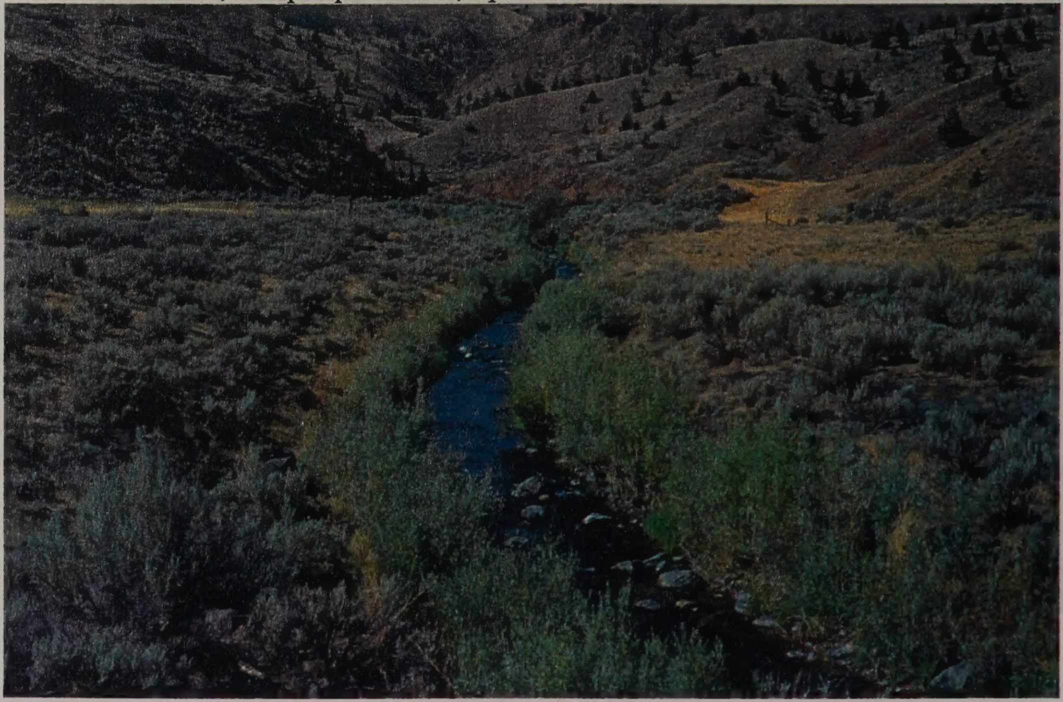


Photo 6. BRNO, sample point #16, downstream view.

Photo 7. BRNO, sample point #16, upstream view.

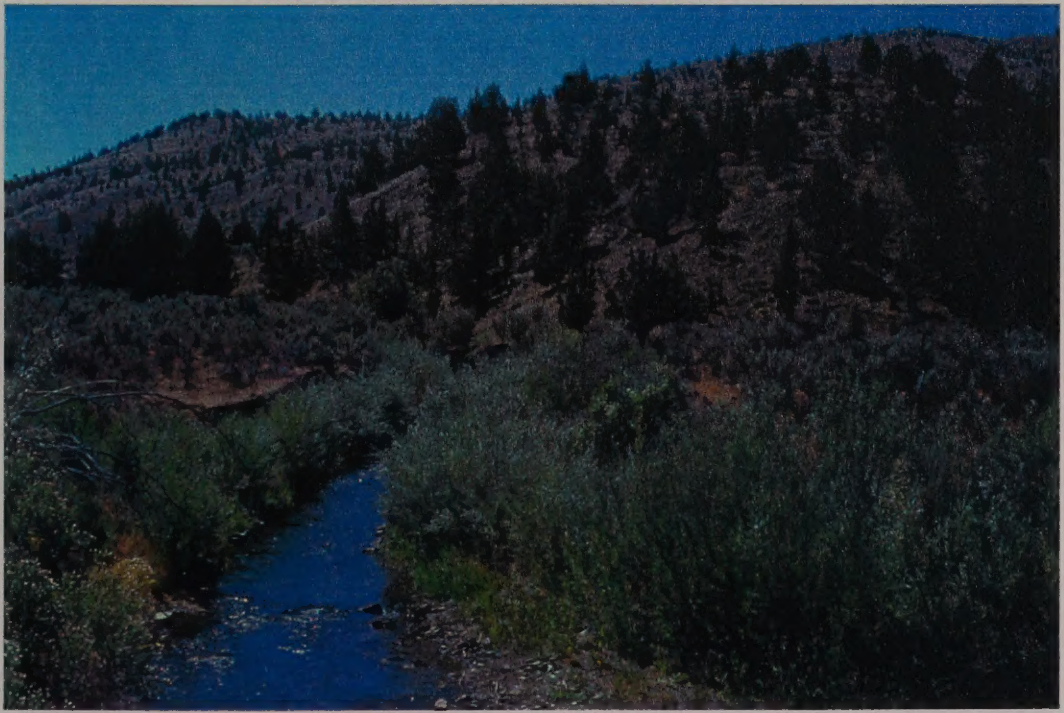
BRSO – Bridge Creek "South" (1999 and 2000)
This study site is located on BLM managed land on Bridge Creek in Wheeler County, along Burnt Ranch Rd (off Hwy 26, west of Mitchell). The upstream perimeter is located at the first cattle guard on BLM managed property north of Hwy 26. The downstream perimeter is located approximately 2.5 km. downstream, south of Bear Creek Rd. See study site locater map (Appendix 7; Map 2).

Habitat along this study site was riparian woodland. The condition of the riparian woodland habitat varied along the length of the study site, including wider patches of woody vegetation up to 50 meters in width and narrow corridors of willows only a few meters in width (see Photos 8 and 9). Average cover of riparian shrubs was approximately 24%, composed primarily (~20%) of *Salix* species. Upland habitat included sagebrush shrub-steppe and juniper woodlands. In some areas, particularly the upstream section, juniper woodlands encompassed the riparian zone. In other areas, sagebrush encroached on the riparian zone right to the edge of the stream.

Several different riparian species were observed on this study site, including one riparian habitat indicator species, Yellow Warbler, which was observed on four and five of the 13 points in 1999 and 2000 respectively. These observations of Yellow Warblers were all made on the upstream section of the study site, where the woody vegetation was more extensive and complex. Several other riparian species were observed including Song Sparrows, Lazuli Buntings, Western Wood-pewees, Bullock's Orioles, and American Goldfinches. Although not necessarily indicators of riparian habitat in good condition, they indicate the presence of both a shrub or understory component, and a tree component (the juniper woodlands) that allow the habitat to support a diversity of species. Management activities should focus on increasing the overall amount of riparian shrub cover and the diversity of riparian shrub species, and extending the better riparian woodland habitat further downstream into those areas where upland habitat encroachment is occurring.

Photo 8. BRSO, sample point #1, upstream view.

Photo 9. BRSO, sample point #12, upstream view.



MUCR – Mud Creek (1999)
This study site is located in Wheeler County on BLM managed land on sections of Gable and Mud Creek. The downstream perimeter of the study site is located on Gable Creek near the beginning of Gable Creek Road (which is located off highway 26, west of Mitchell and east of Burnt Ranch Rd.). The study site continues upstream along Mud Creek after it enters Gable Creek and the upstream perimeter is approximately 1.75 kilometers from the beginning of the study site. See study site locater map (Appendix 7; Map 2).

This study site had a fairly narrow riparian corridor with the width of the woody riparian zone ranging between zero and 15 meters. The condition of the riparian habitat varied from areas with no woody and little herbaceous riparian vegetation, to patches of several woody species and tall, dense and lush herbaceous vegetation (see Photos 10 and 11). Upland habitat included sagebrush shrub-steppe, juniper woodlands, and open meadow. Several riparian bird species were observed on the study site, including breeding Song Sparrows, Lazuli Buntings and American Goldfinches. A Wilson's Warbler, which is a good indicator of riparian condition, was observed once in 1999. Because of the narrow stream channel, the potential for this area to support an extensive woody riparian habitat is limited. However, further restoration of woody vegetation along the downstream section could perhaps result in a woody riparian zone wide enough to support Yellow Warblers.

Photo 10. MUCR, sample point #4, upstream view.

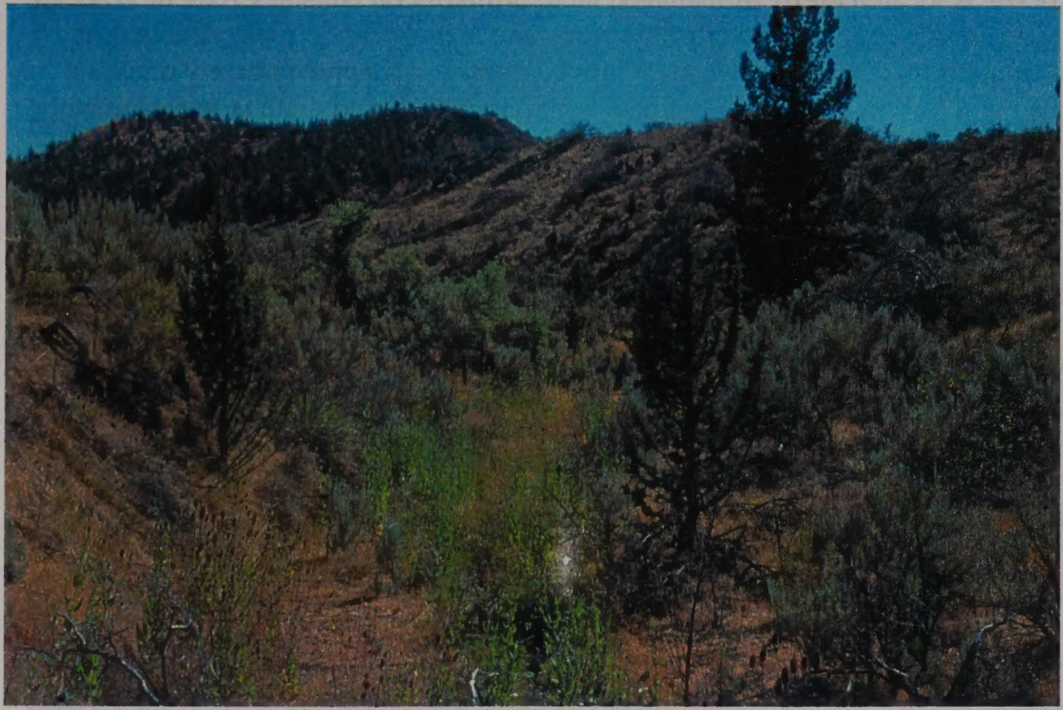
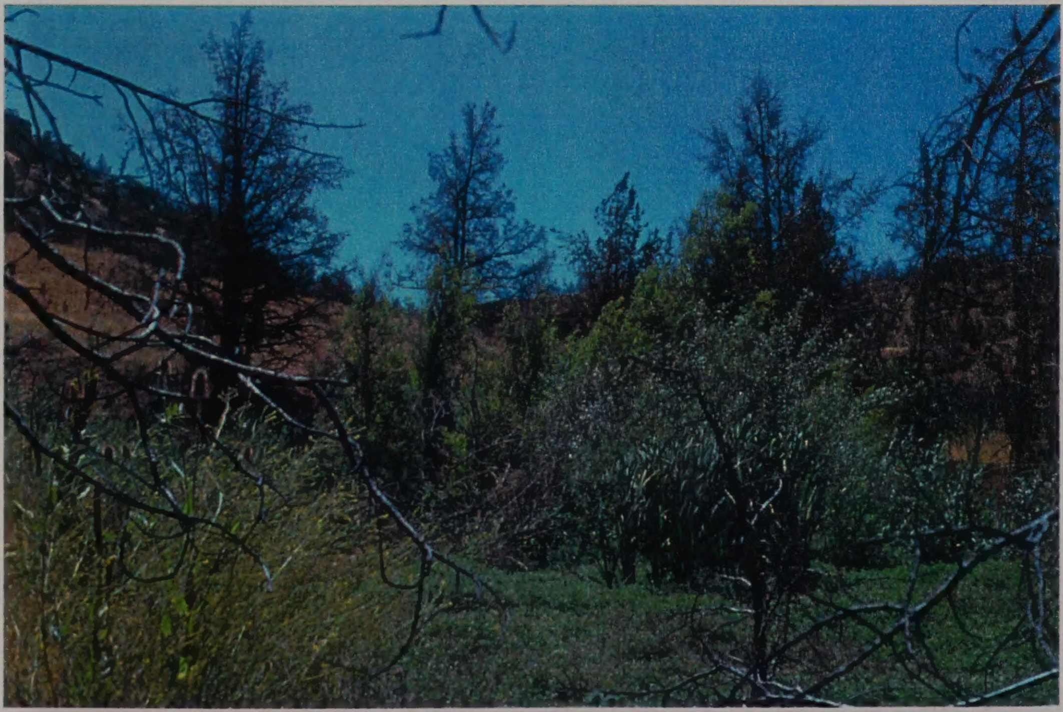


Photo 11. MUCR, sample point #11, upstream view.



NECR – Nelson Creek (1999)
This study site is located on BLM managed land, primarily on Nelson Creek in Wheeler County. The downstream perimeter of the study site is on Bridge Creek, at the point where the creek flows under highway 26 from south to north, approximately one mile west of the town of Mitchell. The upstream boundary of the study site is approximately 1.25 kilometers up Nelson Creek. See study site locater map (Appendix 7; Map 2).

The downstream section of the study site located on Bridge Creek supports a narrow corridor of woody riparian vegetation, primarily *Salix exigua* (see Photo 12). Further upstream on the study site, on Nelson Creek, the stream channel narrows, and only small, scattered patches of riparian vegetation are found (see Photo 13). The upland habitat is primarily sagebrush shrub-steppe and juniper woodland. No riparian indicator songbirds were observed as probable breeders. However, a Wilson's Warbler and a Yellow Warbler were each observed on one occasion. Like MUCR, the section of this study site on Nelson Creek has only a narrow stream channel and therefore the potential for the woody riparian zone to widen extensively is limited. However, there is likely potential for a narrow corridor of woody riparian vegetation to be supported beyond what is currently there, and therefore there is potential for an increase in the amount of riparian songbird habitat on this study site.

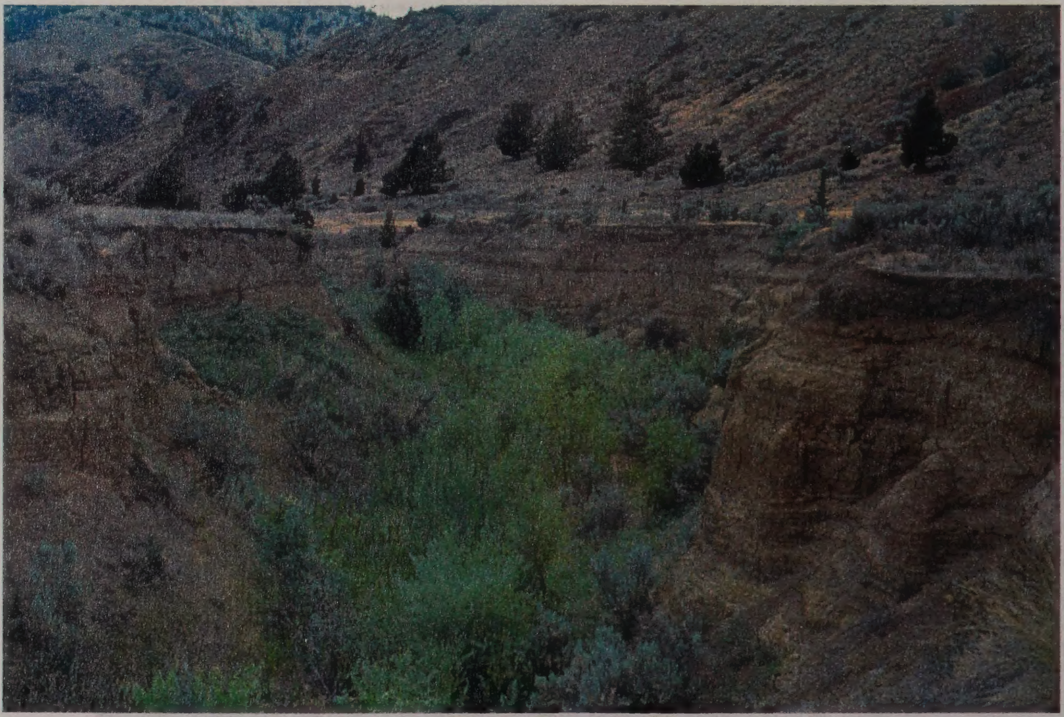
Photo 12. NECR, sample point #2, upstream view.

Photo 13. NECR, sample point #8, upstream view.

MECA – Meyer's Canyon (1999)
This study site is located in Wheeler County on BLM managed land in Meyer's Canyon. The downstream perimeter of the study site is located at Burnt Ranch Rd., where Meyer's Canyon enters Bridge Creek. The upstream perimeter is located approximately 1.5 kilometers upstream. See study site locater map (Appendix 7; Map 2).

Meyer's Canyon is a small stream located at the bottom of a narrow, deep ravine or gully. The stream emerges close to the upstream end of the study site, and the emergent flow across much of the bottom of the ravine results in sections of thick and lush herbaceous and woody riparian vegetation (see Photo 14). Flow at the downstream end is restricted to the channel, and the associated riparian habitat is a narrow corridor. No riparian indicator species were observed in Meyer's Canyon. However, several other riparian species were observed including: Western Wood-pewees, Song Sparrows, Lazuli Buntings, Bullock's Oriole, and American Goldfinches. Because of the restriction of the habitat to the "canyon", the riparian habitat will never extend beyond the approximately five meter width of the canyon, and therefore will not likely support any species requiring more extensive woody riparian habitat than Song Sparrows.

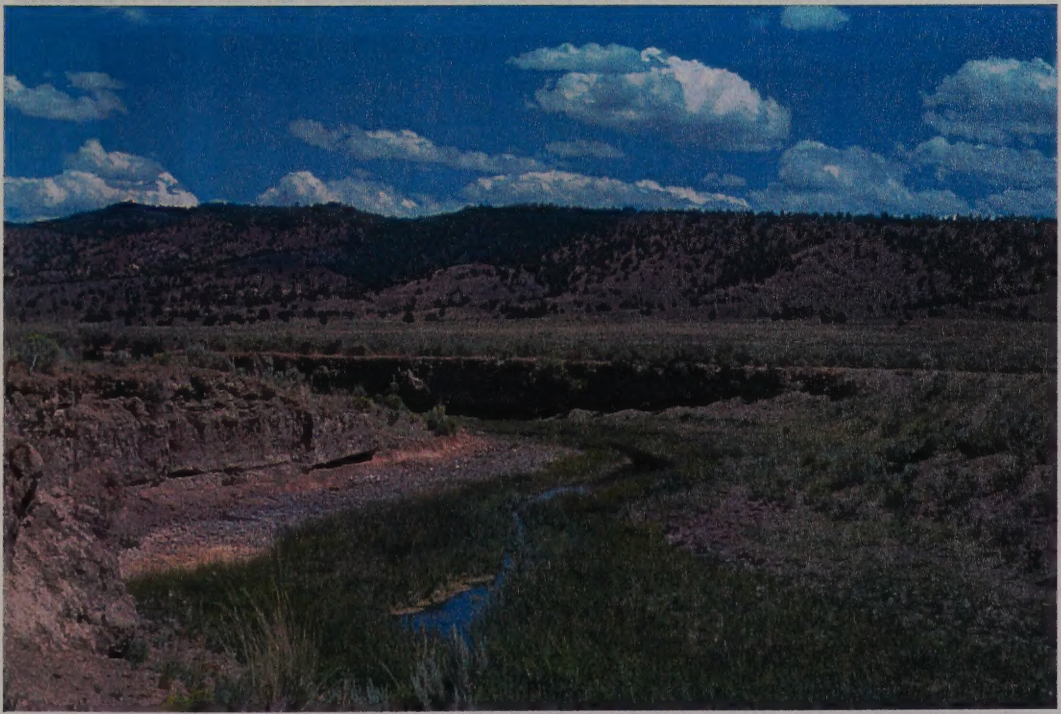
Photo 14. MECA, sample point #3, downstream view.



CANO – Camp Creek "North" (1999)
This study site is located on Camp Creek in Crook County, on sections of Carl Weaver and Bill Connelly's property, downstream of the property boundary with BLM managed land. See study site locater map (Appendix 7; Map 3).

The riparian habitat of this study site was primarily wet meadow, surrounded by an upland habitat of vast sagebrush flats. The riparian habitat was currently in a degraded condition, and highly downcut sections of the stream indicate historical degradation (see Photo 15). Sections of this study site were observed to be grazed by livestock during the 1999 field season. Only two riparian species were observed, Bank Swallows and Belted Kingfishers. Otherwise, no riparian indicator species were present. Because the riparian habitat type is primarily wet meadow, and because the riparian corridor is surrounded by vast, treeless sagebrush flats, this section of Camp Creek might never support any of the riparian indicator species which are all dependent on complex woody vegetation. Song Sparrows may be able to occupy the area if a small amount of woody cover was able to establish in the riparian corridor.

Photo 15. CANO, sample point #12, downstream view.



CASO – Camp Creek "South" (1999)

This study site is located on BLM managed land along Camp Creek in Crook County, upstream of the property boundary with Carl Weaver to the vehicle crossing access point. See study site locater map (Appendix 7; Map 3).

Like the downstream study site on Camp Creek, CANO, the riparian habitat on this study site is primarily wet meadow with an upland habitat of sagebrush flats and junipers. The number of junipers within the vicinity of the riparian corridor was greater on this section of the stream than on CANO. By the evidence of the highly downcut streambed, this region likely had a history of degradation. The historical "streambanks" were continuing to erode in areas, but the current condition of the riparian vegetative zone included lush, thick herbaceous riparian vegetation, some woody riparian vegetation (primarily *Salix* species under 0.5 meters in height and a few Russian Olive (*Elaeagnus augustifolia*) shrubs), and several small beaver dams (see Photo 16). No riparian species were observed on this study site in 1999. Like the downstream section, this habitat is unlikely to support any of the riparian indicator species, but may be able to support Song Sparrows with an increase in the shrub component.

Photo 16. CASO, sample point #5 showing small beaver dam.

DUBS – Donnor und Blitzen River (2000)
This study site is located on BLM managed land along the Donnor und Blitzen River in Malheur County. The downstream perimeter for the study site is located at the edge of the Page Springs campground. See study site locater map (Appendix 7; Map 4).

The Donner und Blitzen River in the area of the study site is quite wide, ranging between 15 and 25 meters in width. Numerous smaller channels are found within the floodplain. Woody riparian vegetation is extensive; within the study area an average width of 38 meters, a maximum width of over 100 meters in some areas and an average shrub height of 3.3 meters were measured (see Photo 17). Generally, across the study site, the woody vegetation is patchy and is separated by patches of open meadow with scattered sagebrush and juniper, or patches of lush, emergent, riparian herbaceous vegetation, such as cattails (see Photo 18). The greatest number of riparian indicator songbird species that were likely breeding were observed on this study site. Common Yellowthroats, Yellow-breasted Chats and Yellow Warblers were all observed regularly. Other riparian species observed as breeders include Song Sparrows, Western Wood Pewees, Lazuli Buntings, and Bullock's Orioles. Both Lesser and American Goldfinches were observed, as well as Black-headed Grosbeaks. The riparian habitat on this study site was characterized by a high diversity of riparian shrub species, a dense woody understory, and tall riparian trees. It is this complexity of woody, combined with the lush herbaceous riparian vegetation, that allows the habitat to support a diversity of riparian songbirds.

Photo 17. DUBS, sample point #1, downstream view.

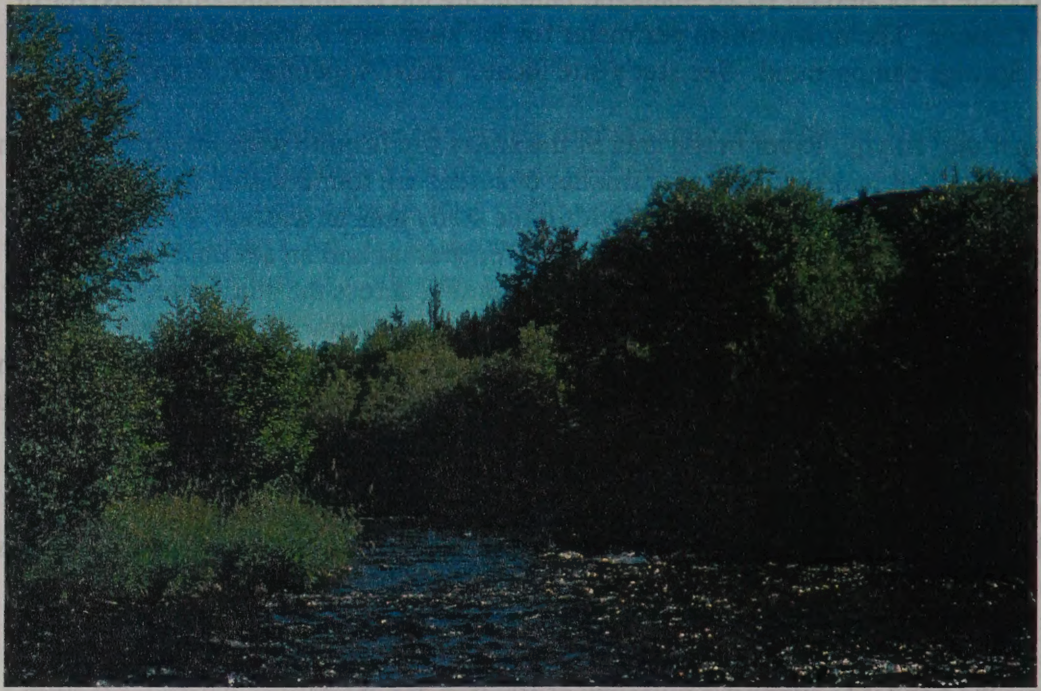


Photo 18. DUBS, sample point #3, downstream view.

SJDA – South Fork John Day, Section "A" (2000)
This study site is located on BLM managed land along the South Fork of the John Day River in Grant County. The perimeter lies upstream from the town of John Day, approximately between river miles 9 and 12. The study site includes the Murderer's Creek grazing allotment. See study site locater map (Appendix 7; Map 5).

The South Fork of the John Day River ranges between five and 18 meters in width in the area of these four study sites. Along the most downstream section, study site "A", the riparian woodland habitat is extensive, characterized by tall riparian trees, a dense woody understory, an average woody riparian zone width of 35 meters, a maximum riparian zone width of over 60 meters, an average shrub height of approximately 2.4 meters, a high diversity of riparian shrub species, an average riparian shrub cover of 55% and emergent, herbaceous riparian vegetation along the banks (see Photo 19). Upland habitat included sagebrush shrub-steppe, and mixed juniper-Ponderosa Pine-Douglas Fir woodlands. Two riparian indicator species were observed, Yellow Warblers and Yellow-breasted Chats. Yellow Warblers were observed abundantly as breeders along this section. Other riparian songbirds observed include Western Wood-pewees, Warbling Vireos, Song Sparrows, Black-headed Grosbeaks, Lazuli Buntings, Bullock's Orioles, and American Goldfinches. This study site provides good riparian habitat for songbirds along much of its length.

Photo 19. SJDA, sample point #9, downstream view.

SJDB – South Fork John Day, Section "B" (2000)

This study site is located on BLM managed land along the South Fork of the John Day River in Grant County. The study site is upstream from SJDA, approximately between river miles 13.75 and 15.5, and includes a section of the Black Canyon Wilderness area, and the Black Canyon grazing allotment. See study site locater map (Appendix 7; Map 5).

The riparian habitat in section "B" is also characterized by a diverse, extensive and complex woody vegetation component (see Photo 20). The estimated average riparian shrub cover was almost 70%, and the average width of the woody riparian zone measured 48 meters. Upland habitat along this section was becoming more predominantly mixed coniferous woodland. Again, observations of Yellow Warblers and Yellow-breasted Chats indicate riparian habitat in good condition, and Yellow Warblers were observed abundantly as breeders. An extensive list of other riparian species were observed along this section including Lewis' Woodpeckers, House Wrens, American Dippers, Song Sparrows, Black-headed Grosbeaks, Lazuli Buntings, Bullock's Orioles, and American Goldfinches. As well, one observation of a Bald Eagle was made along this section of the South Fork of the John Day River. This study site also provides good habitat for riparian songbirds.

Photo 20. SJDB, sample point #10, upstream view.

SJDC – South Fork John Day, Section "C" (2000)

The study site is located on BLM managed land along the South Fork of the John Day River in Grant County. The study site is upstream from section "B", and falls approximately between river miles 17 and 20, and includes the Rockpile, North Corridor pasture grazing allotment. See study site locater map (Appendix 7; Map 5).

The riparian habitat along section "C" is confined to a narrower corridor, limited by the road on one side, and the Ponderosa Pine woodland on the other (see Photo 21). The average width of the woody riparian zone measured approximately 15 meters, and was characterized by vegetation approximately two meters in height. An average of nine different riparian species were observed along this section, and an average riparian shrub cover of 40% was estimated. Upland habitat along this section was also predominantly mixed coniferous woodland. The only riparian indicator species observed were Yellow Warblers. The lack of Yellow-breasted Chats along this section compared with other sections along the South Fork could be attributed to the narrower riparian corridor. The suite of other riparian associated species observed was less diverse than on the other sections and included Lewis' Woodpeckers, Song Sparrows, Lazuli Buntings, Bullock's Oriole, and American Goldfinches. The lower diversity of riparian species observed is indicative of the lower complexity of the woody vegetation along this section. This study site provides moderately good riparian habitat for songbirds, and because of the confinement of the corridor, it is likely close to meeting its full potential as riparian songbird habitat.

Photo 21. SJDC, sample point #2, upstream view.

SJDD – South Fork John Day, Section "D" (2000)

The study site is located on BLM managed land along the South Fork of the John Day River in Grant County. It is upstream from SJDC, approximately between river miles 25.5 and 27. See study site locater map (Appendix 7; Map 5).

This final, upstream section of the South Fork of the John Day River had a less complex woody riparian zone. The woody riparian zone in this section was not constrained by the landscape like the downstream section, but the average width measured only 30 meters and the average riparian shrub cover estimate was comparable to the constrained downstream section at 40% (see Photo 22). Generally, woody vegetation was patchy and separated by sections of open meadow. Cattle were observed on this study site in June, 2000. Upland habitat included a shrub component (sagebrush/bitterbrush dominated), and woodlands of juniper and other coniferous species. Yellow Warblers and one Yellow-breasted Chat were observed along this section. Other riparian associated species observed include Lewis' Woodpecker, Western Wood-pewee, Warbling Vireo, Song Sparrow, Black-headed Grosbeak, Lazuli Bunting and Bullock's Oriole. Although supporting riparian indicator species, this study site is likely not meeting its full potential as riparian woodland habitat and would benefit from management to increase the overall riparian shrub cover and average width of the woody riparian zone.

Photo 22. SJDD, sample point #1, upstream view.

TEMI – Ten Mile Creek (2000)
This study site is located on Ten Mile Creek in Deschutes County, on private land owned by Bill Atherton and on BLM managed lands. The downstream perimeter of the study site is located where Ten Mile Creek enters Trout Creek; the study site ended approximately 1.8 km. upstream. See study site locater map (Appendix 7; Map 6).

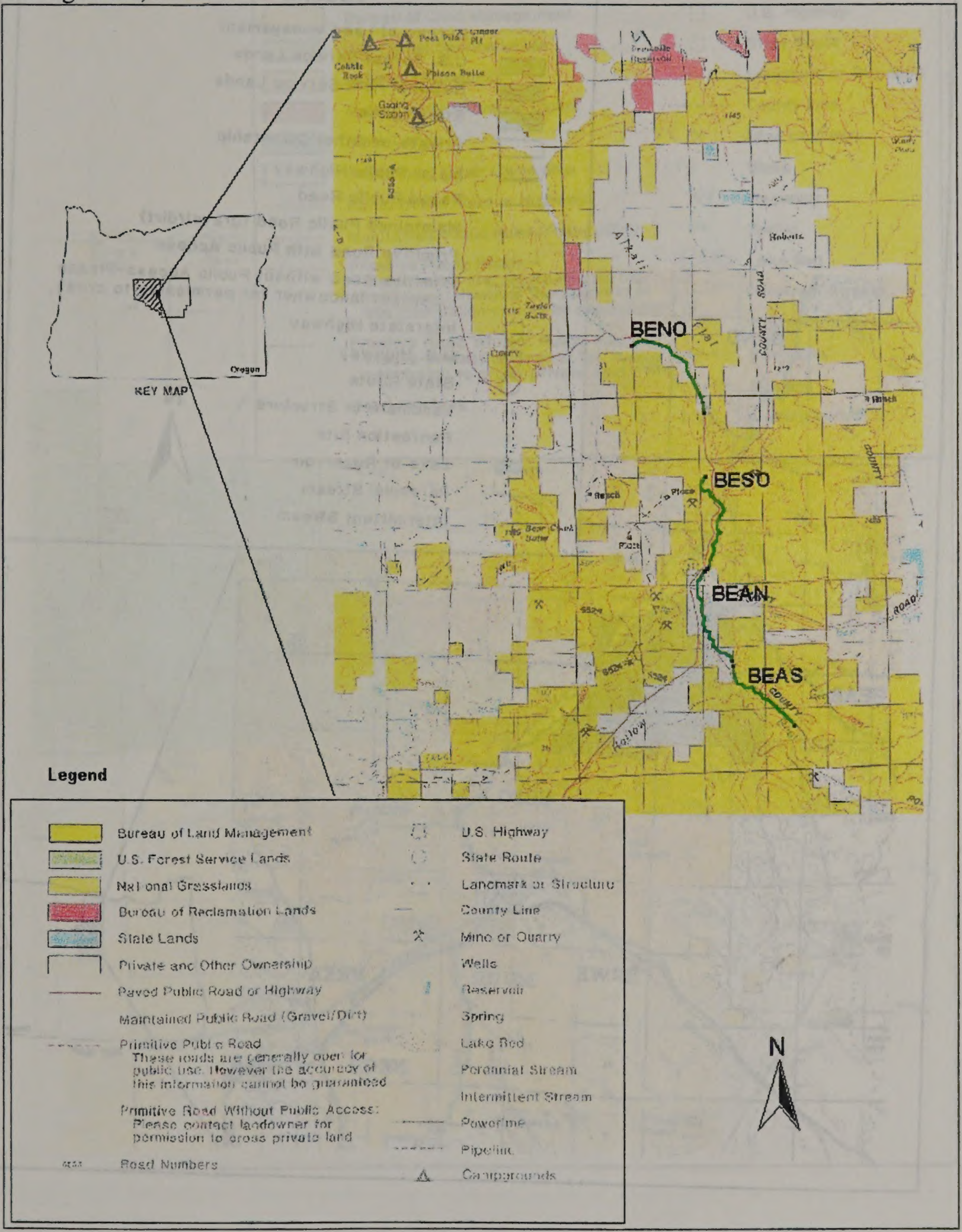
Riparian habitat on the privately owned downstream section of this study site was characterized by a low percent cover of riparian shrubs (~4%) and a narrow woody riparian zone (~9 meters). Just upstream, the first section (~3 survey points or 600+ meters) on BLM managed land had a wide woody riparian zone (between 30 and 60 meters), a dense understory and up to ten different riparian shrub species (see Photo 23). Further upstream, the woody riparian vegetation became patchy and less dense (see Photo 24). Upland habitat included sagebrush shrub-steppe, juniper woodlands, and steep canyon slopes. A single breeding pair of Yellow-breasted Chats was observed on this study site. This is the only riparian indicator species that was observed. No Yellow Warblers were observed at any time along this stream, despite apparently sufficient patches of riparian woody vegetation. Other riparian species observed as probable breeders were indicative of the moderate complexity of the woody vegetation. Lazuli Buntings are associated with patchy shrubs, and Bullock's Orioles and American Goldfinches are frequently found in areas with tall trees. Of interest was the single observation of a Red-eyed Vireo.

Photo 23. TEMI, sample point #3, downstream view.

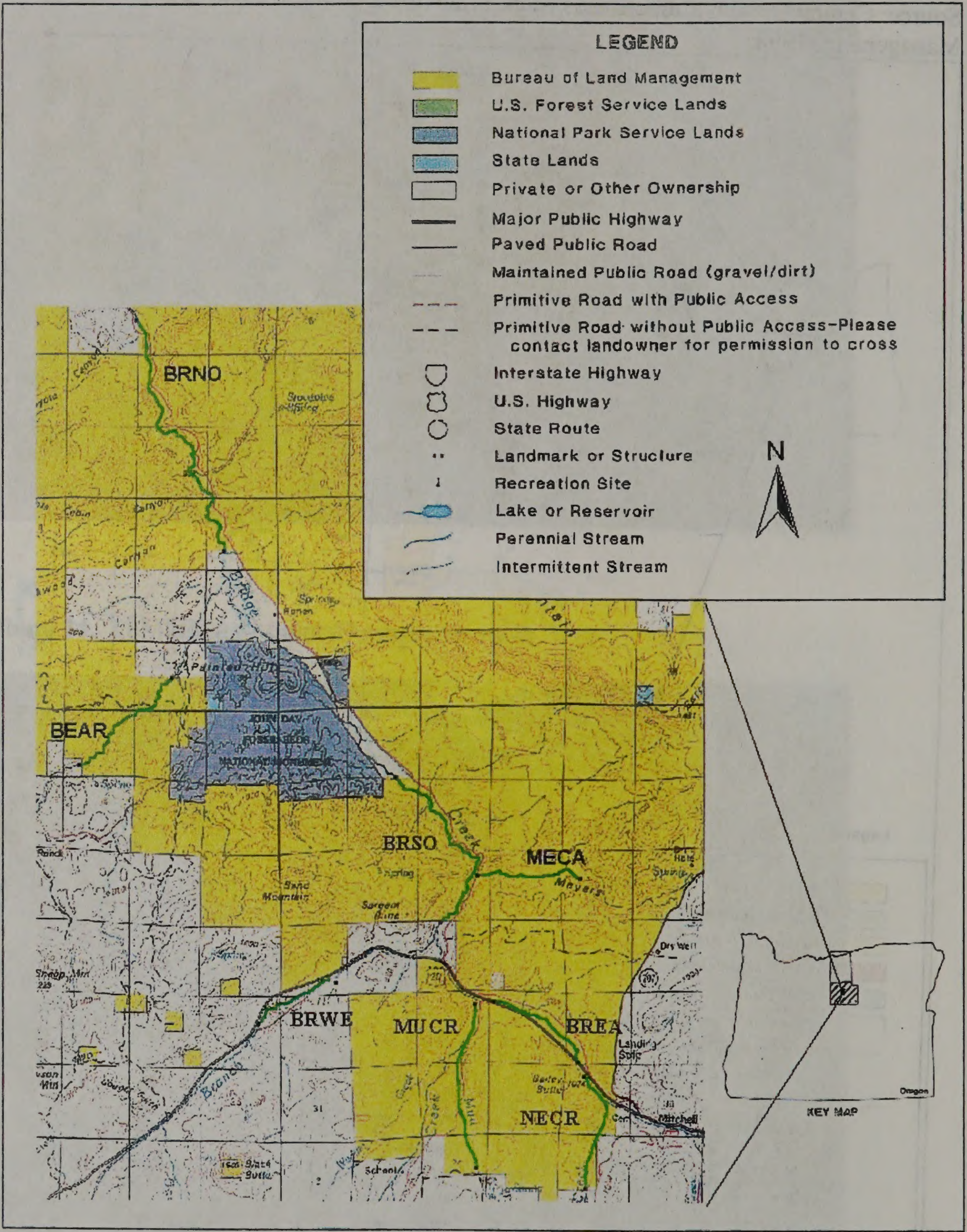
Photo 24. TEMI, sample point #9, upstream view.

Appendix 7. Study site locator maps.

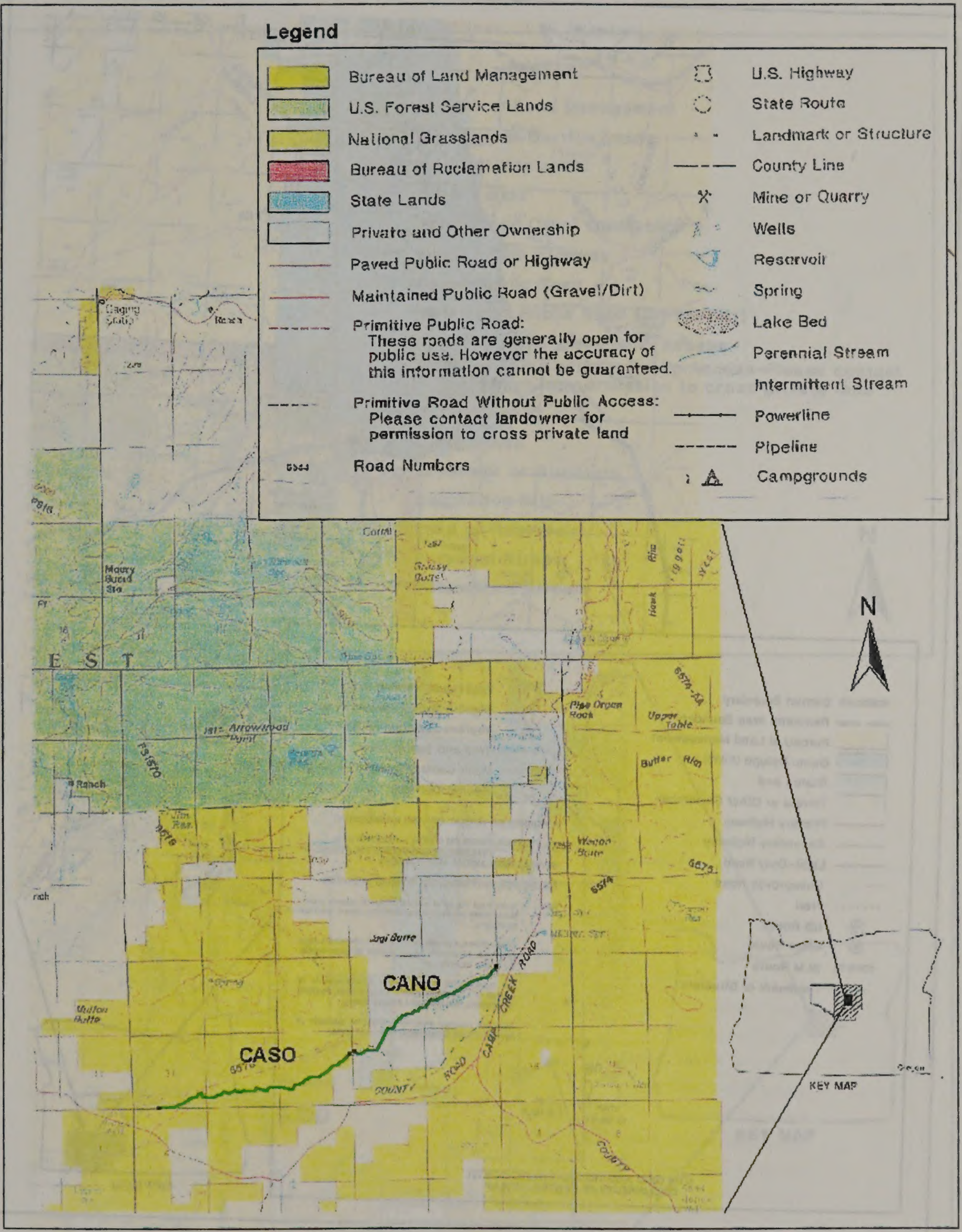
Map 1. Study sites BEAN, BEAS, BESO and BENO on Bear Creek, Crook County. Source: Central Oregon Public Lands Map, Prineville District, Bureau of Land Management, 1998.


BENO
BESO
BEAN
BEAS
Oregon
KEY MAP
Legend
Bureau of Land Management
U.S. Forest Service Lands
National Grasslands
Bureau of Reclamation Lands
State Lands
Private and Other Ownership
Paved Public Road or Highway
Maintained Public Road (Gravel/Dirt)
Primitive Public Road
These roads are generally open for public use. However the accuracy of this information cannot be guaranteed
Primitive Road Without Public Access:
Please contact landowner for permission to cross private land
Road Numbers
U.S. Highway
State Route
Landmark or Structure
County Line
Mine or Quarry
Wells
Reservoir
Spring
Lake Bed
Perennial Stream
Intermittent Stream
Powerline
Pipeline
Campgrounds
N

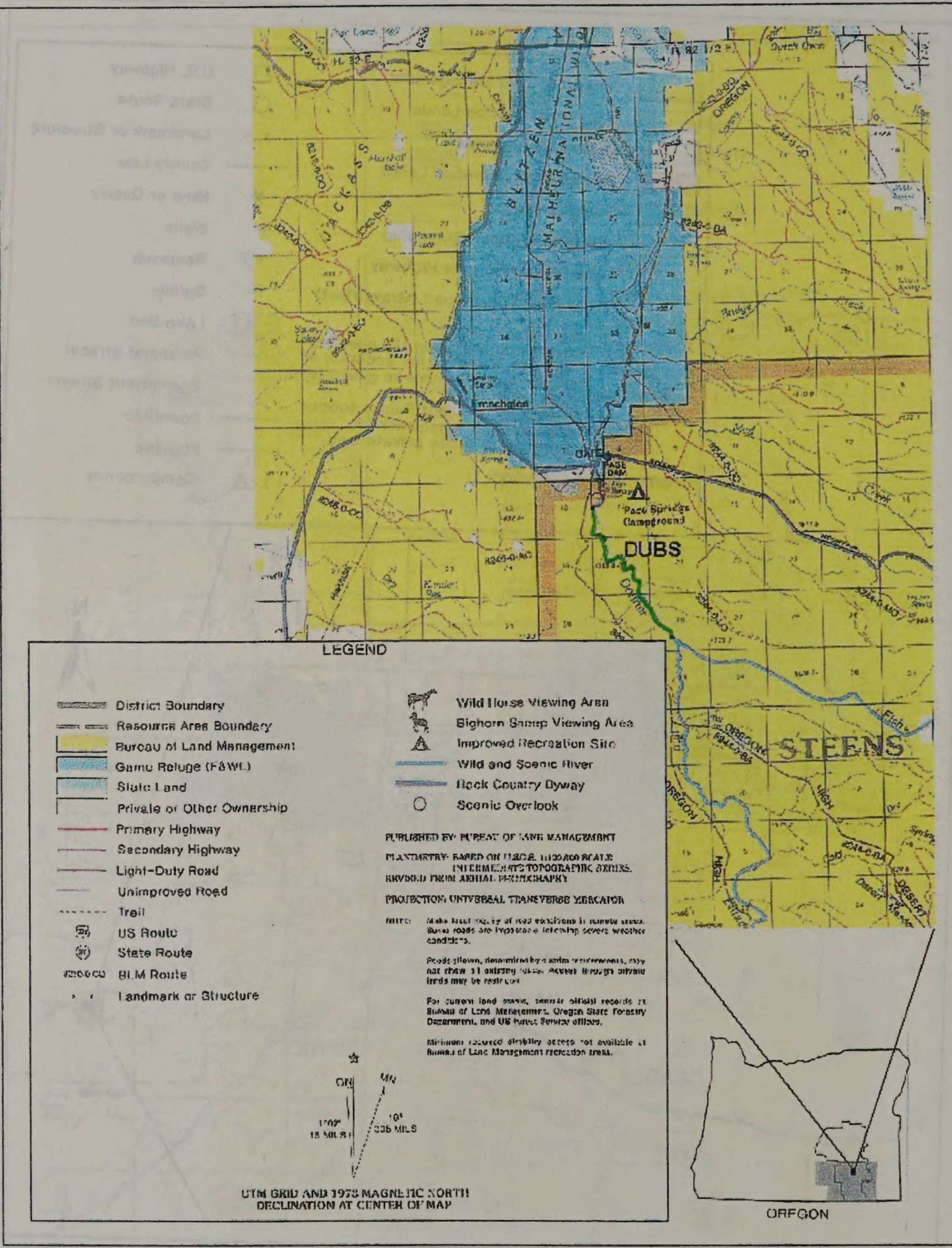
Map 2. Study sites BEAR, BREA, BRNO, BRSO, BRWE, MECA, MUCR, and NECR in the Bridge Creek Watershed, Wheeler County. Source: Lower John Day River Public Lands Map, Prineville District, Bureau of Land Management, 1991.



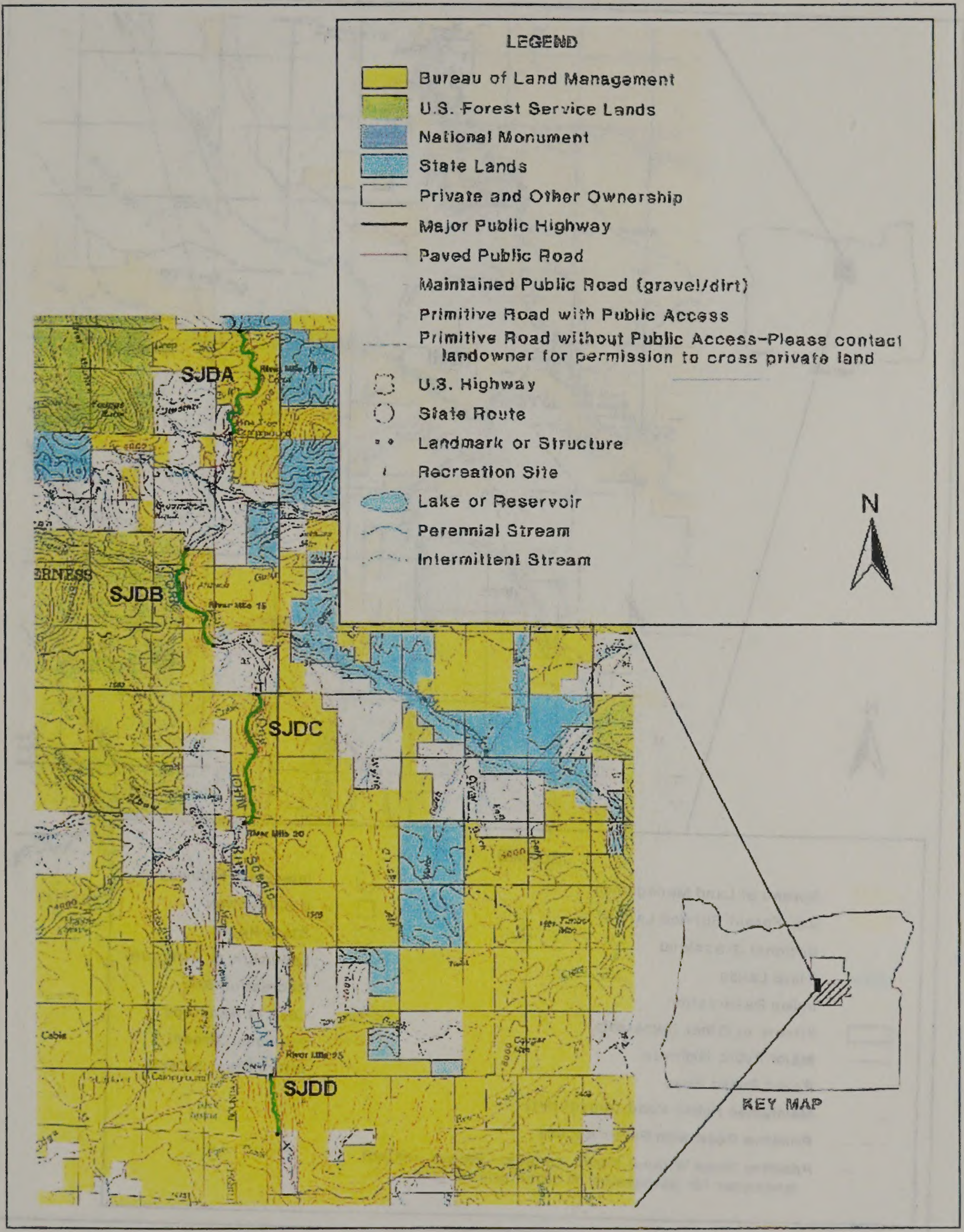
Map 3. Study sites CANO and CASO on Camp Creek, Crook County. Source: Central Oregon Public Lands Map, Prineville District, Bureau of Land Management, 1998.


Legend
Bureau of Land Management
U.S. Forest Service Lands
National Grasslands
Bureau of Reclamation Lands
State Lands
Private and Other Ownership
Paved Public Road or Highway
Maintained Public Road (Gravel/Dirt)
Primitive Public Road: These roads are generally open for public use. However the accuracy of this information cannot be guaranteed.
Primitive Road Without Public Access: Please contact landowner for permission to cross private land
Road Numbers
U.S. Highway
State Route
Landmark or Structure
County Line
Mine or Quarry
Wells
Reservoir
Spring
Lake Bed
Perennial Stream
Intermittent Stream
Powerline
Pipeline
Campgrounds
CANO
CASO
CAMP CREEK ROAD
COUNTY ROAD
Pipe Organ Rock
Upper Table
Arrowwood Point
N
KEY MAP

Map 4. Study site DUBS on the Donner und Blitzen River, Harney County. Source: Burns District South Half map, Burns District, Bureau of Land Management, 1994.



Map 5. Study sites SJDA, SJDB, SJDC and SJDD on South Fork of the John Day River, Grant County. Source: Upper John Day River Public Lands map, Prineville District, Bureau of Land Management, 1991.



Map 6. Study site TEMI on Ten Mile Creek, Deschutes County. Source: Lower Deschutes River Public Lands map, Prineville District, Bureau of Land Management, 1989.